Vol. XCI JANUARY, 1930 JAN 7 1930 No. 1

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by LEWIS STEPHEN PILCHER, M.D., LL.D., of New York

ASSOCIATE EDITORS

W. SAMPSON HANDLEY, M.S., M.D., F.R.C.S., of London.
JAMES TAFT PILCHER, B.A., M.D., of New York.
JOHN H. JOPSON, M.D., of Philadelphia.

Official Publication of the American Surgical Association of the New York Surgical Society and the Philadelphia Academy of Surgery

SEMICENTENNIAL OF THE NEW YORK SURGICAL SOCIETY OCTOBER, 1929

INTRODUCTORY REMARKS, the President, EDWIN BEER, M.D., New York, N. Y.

INFLUENCE OF THE NEW YORK SURGICAL SOCIETY ON THE DEVELOPMENT OF SURGERY. FREDERICK BATES LUND, M.D., Boston, Mass.

EARLY DAYS OF THE NEW YORK SURGICAL SOCIETY, WILLIAM JAMES MAYO, M.D., Rochester, Minnesota.

THE SEMICENTENNIAL OF THE NEW YORK SURGICAL SOCIETY, ELLSWORTH ELIOT, M.D., New York, N. Y.

ORIGINAL MEMOIRS: Tumors of the Pituitary Body, of the Thyroid, of the Testicle, of the Spinal Column; Papers on Thoracoplasty for Pulmonary Tuberculosis, Tuberculosis of the Colon simulating cancer, Tuberculosis of the Prostate; Papers on Problems in Surgical Lesions of the Kidneys and of the Ureter; on Peptic Ulcer, on the treatment of external Gastrointestinal Fistulæ.

NEW YORK SURGICAL SOCIETY DISCUSSION on Thoracoplasty for Pulmonary Tuberculosis.

BRIEF COMMUNICATIONS. BOOK REVIEWS.

Full Table of Contents on Advertising Page 2

J. B. LIPPINCOTT COMPANY, PUBLISHERS

MONTREAL PHILADELPHIA LONDON

Entered at the Post Office at Philadelphia and admitted for transmission through the mails at second-class rates. Price $10.00 a year.
Copyright 1930, by J. B. LIPPINCOTT COMPANY, 227-231 South Sixth Street.

In pneumonia
Start treatment early

In the

Optochin Base

treatment of pneumonia every hour lost in beginning treatment is to the disadvantage of the patient. Valuable time may often be saved if the physician will carry a small vial of Optochin Base (powder or tablets) in his bag and thus be prepared to begin treatment immediately upon diagnosis.

Literature on request

MERCK & CO. INC. Rahway, N. J.

The Heating Season Is Here—

TO prevent "colds" and "sore throats" from developing into virulent onslaughts of respiratory disease—

and to protect against relapses or dangerous sequelae—your patients need adequately heated and ventilated rooms—and above all—

The increased power of resistance, the better metabolic function, which

Gray's Glycerine Tonic Comp.

(Formula Dr. John P. Gray)

usually effects.

Samples and literature on request

THE PURDUE FREDERICK CO., 135 Christopher St., New York

Medical
Walter
Coll. 1

ANNALS *of* SURGERY

Vol. XCI JANUARY, 1930 No. 1

THE SEMICENTENNIAL ANNIVERSARY

OF THE FOUNDING OF THE

NEW YORK SURGICAL SOCIETY

Held October 30, 1929

INTRODUCTORY REMARKS

By the President, EDWIN BEER, M.D.

A LITTLE over fifty years ago surgery had its renascence. To appreciate what enormous strides this comparatively new therapeutic discipline has made during these years baffles one's intelligence. Surgery of a sort had been practised for thousands of years but not until the epoch-making contributions of Pasteur and of Lister was it possible for modern surgery to commence its grand career and real life. Prior to those important discoveries there were a few limited surgical specialistic activities but surgery, as we all know it, was an impossibility and its beneficent usefulness to mankind became a possibility only after a full realization of the significance of the work of those two genial spirits.

With the opening up of this new therapeutic field, those who were specially interested in furthering its progress, in learning its heretofore hidden secrets, felt the need of a forum of their peers where honest search for truth and critical analysis might be found. This need was recognized almost simultaneously in many countries and in many cities. Surgical societies sprang up both here and abroad to meet the situation. The German Surgical Society, The American Surgical Association, The Philadelphia Academy of Surgery, and The New York Surgical Society—to mention only some of the responses to this urge—all saw the light of day in the 'seventies of the last century.

On October 30, 1879, the first meeting of The New York Surgical Society took place. To assist our minds in getting back to that date, to adjust our viewpoint to the activities of our founders (which will be spoken of by the guests of the evening), it would be well to read to you the minutes of the meeting held half a century ago:

> At a meeting held October 30, 1879, at the residence of Dr. Robert F. Weir, the New York Surgical Society was organized with the following gentlemen as original members: Drs. H. B. Sands, E. L. Keyes, L. A. Stimson, Charles McBurney, T. T. Sabine, Wm. T. Bull, R. F. Weir, and J. G. Curtis.

1. It was resolved that the meetings of the Society should be semi-monthly and be held during the months of October, November, December, January, February, March, April and May.

2. That the meetings should begin at eight o'clock and that business should be transacted in the following order:

1. Presentation of patients and discussion of the same.
2. The subject of the evening.
3. Narration of cases with comments.
4. Presentation of pathological specimens.
5. Reports of committees.
6. Miscellaneous business.

3. That the meetings should be held at the houses of members in alphabetical order and that no supper should be allowed.

4. That no member shall be allowed more than ten minutes of the Society's time except in the stated discussion.

5. The officers of the Society shall be three in number, namely, President, Vice-president, and Secretary and Treasurer.

6. That two negative votes shall reject a candidate for membership.

An election of officers was then held and Doctor Sands was made President, Doctor Weir Vice-president, and Doctor McBurney Secretary pro tem. The following gentlemen were elected members of the Society—Drs. Van Buren, Markoe, Peters, Mason, Little, Lange, and Guleke.

The Society then adjourned to meet November 4 for complete organization.

R.F.W.

Following the October 30 meeting, the organization was perfected at the November 4 meeting and the first scientific session took place November 25 at the house of Dr. William T. Bull, at which thirteen members were present. Doctor Van Buren read a paper on "Submental and Subhyoid Cysts" which was discussed by Doctors Peters, McBurney, Markoe, Little and Sands. Doctor Peters presented a case of litholapaxy followed by profuse peri-urethral suppuration. This was discussed by Doctors Van Buren, Sands and Keyes. Doctor Stimson then showed the results of a series of experiments undertaken to determine whether or not the carbolic spray actually purified the air, as Lister claimed.

These few words present the background of the Society's birth. The first speaker at this meeting to celebrate the semicentennial year of the Society's existence will be Dr. Fred Lund, of Boston, President of the American Surgical Association, not only a surgeon of renown but a student of surgical history, who will address us on the subject of "The Influence of the New York Surgical Society on the Development of Surgery."

THE INFLUENCE OF THE NEW YORK SURGICAL SOCIETY ON THE DEVELOPMENT OF SURGERY

By Fred Bates Lund, M.D.
of Boston, Mass.

In the genealogy of the Greek gods, you will find the beautiful myth that memory, or *Mnemosyne*, was the mother of the muses. I cannot do better than to begin our proceedings with a prayer to her.

Oh! Mnemosyne, mother of the muses, who gives to man his greatest gifts from heaven, the power of song and story and the things of the spirit and the mind, I pray thee look with favor upon thy suppliant, who attempts to tell the story in thirty minutes of fifty years of the active, seething life of this Society. Turn kindly toward him the spirits of the illustrious dead and the hearts of his living auditors; if he, as he will, leaves unsaid the things that he ought to have said and says the things that he ought not to have said, and his words prove inadequate, may they accept in their place his right good will. Amen.

The New York Surgical Society did not, like the Goddess Athena, spring full-armed from the head of Zeus, with sword, shield and ægis complete, but none the less it had its origin in the brain of a great man. The brain was that of Dr. Lewis A. Stimson, who wrote the textbook on fractures, which lasted well into my time, who was a constant contributor to the proceedings of your Society, who was always on the edge of progress looking over the horizon ahead, and who was for many years one of the leading surgeons in New York City. Not the least of his accomplishments was that he was the father of my friend, the Honorable Henry L. Stimson, the Secretary of State of these United States. He had a personal acquaintance with the Société de Chirurgie of Paris and was a constant reader of its bulletins. His suggestion for a surgical society for New York was laid before Van Buren and a few others, who adopted it, and on October 30, 1879, at the house of Dr. Robert F. Weir effected a preliminary organization. These men, like the hand that built St. Peter's dome, builded better than they knew, and the small building, of which they laid the corner stone, has become the mighty edifice of the New York Surgical Society. Those taking part in the first meeting were Doctors Sands, Keyes, McBurney, Stimson, Sabine, Bull, Weir, and J. G. Curtis. Doctor Sands was chosen president and Doctor McBurney secretary.

I always feel a certain pity for the younger men of our profession, for the reason that they cannot have really known the older men whom we ourselves looked up to with such reverence and affection—such men as Doctors Cheever, Homans, C. B. Porter, and Maurice Richardson, in Boston, and in New York the eminent founders of this Society. They can only know them

through our inadequate efforts at the portrayal of their character. A young man's enthusiasm for his teacher is one of the finest things in our profession, and has been so since the time of Hippocrates. These men, the founders of this Society, were the heroes who taught and moulded, and gave character to the profession of Surgery in New York, the greatest city of our country, offering to its members a clinical and hospital experience surpassing that of any other. This Society was a society of surgeons, which meant that whoever read a paper or reported a case was submitting it to a jury of his peers. Think of the advantages to the young surgeon of membership in such a society, a place where professional jealousies are forgotten, where each man is sure of keen criticism, and all are animated by the love of truth and the desire to help their patients. Only surgeons can truly understand or criticize surgical work. That is the reason that surgical societies and surgical sections are the places to present surgical cases. One is also in such meetings free from the imputation of attempting to please the medical public in order to increase his personal gain. Medical men, whose superior wisdom and attainments I would be the last to deny, can never understand our art, which as Aristotle stated, and Henri de Mondeville emphasized, can only be learned by its practice. "If the mind must guide the hand in an operation, the hand instructs the mind in the knowledge of what it can do," said the eminent surgeon of mediæval days. Besides, in a society made up of rival practitioners of surgery, one is always sure of criticism of any defects in his work, which is after all better for one than indiscriminate praise. We must never forget the stimulation to study and effort that the reporting of cases in such a society has upon its members. There is no way so sure to clarify our own knowledge as to present our work for criticism to our peers. I think it was Dr. Charles Mayo who truly said, "the man who gets the most benefit from a paper is the writer of it," and also, "the man who hasn't time to write papers will find in a few years that he has more time on his hands than he wants." To my mind there is no satisfaction greater in one's life than to present something really worth while in a surgical meeting, though I am compelled to admit that in my own life such thrills have been relatively rare.

At the time the New York Surgical Society was founded, as Doctor Stimson stated in 1913, "The differentiation of practice had indeed begun, but, except for certain specialties, such as the eye and ear, it had barely advanced beyond the manifestation of a preference on the part of some general practitioners for certain lines of practice. Even Sands, who was just entering upon the brilliant last ten years of his life, still kept some families, and only two or three, and they young men, had declared an exclusive attention to surgery. Sabine had done so for a few years; Lange had just come to us from Germany. Antiseptic surgery, too, was just establishing itself among us, and it was only three years since the first Lister spray had been brought here and the first operation according to his method had been performed in one of our hospitals. The field of surgery was just beginning to enlarge under its influence, to enter upon that astounding expansion which the last

thirty years have witnessed. The signs of that expansion were already visible, men's thoughts were occupied with the possibilities of future surgery, the need of specialization in it was evident, and, in short, the time was ripe for a society devoted to its consideration."

Since these prophetic words, the expansion has gone on at a rate no less than it had taken on at that time. The substitution of asepsis for antisepsis, X-ray, radium and all the wonders of radiation, the specialties of genito-urinary surgery, orthopædics, the surgery of the nervous system, the enormous refinement of the surgery of the abdomen, transfusion, the surgery of the spleen, and thoracic surgery, in which much good work has been done in New York, are only a few of the fields in which Surgery has spread its beneficent influence, so that it may be truly said that in the last eighty years our art has progressed further than in the three thousand years preceeding.

One of the most valuable things the New York Surgical Society has done is to constantly provide for the publication of its transactions. Dr. Wesley Carpenter reported the earlier discussions which were first published in the New York *Medical Record,* but ever since 1892 have been published in the ANNALS OF SURGERY. All through my own professional life I have enjoyed reading the remarkable cases published in these Transactions and have sometimes been encouraged to go and attempt to do likewise. Such has been the effect of the penetration of the transactions of the New York Surgical Society to a remote and inaccessible part of New England. For the preparation of this address, I have been entrusted with the reports of the Society in manuscript, written by the hands of the secretaries from 1879 to 1919. I have read them reverently and carefully. They, with the transactions published in the ANNALS OF SURGERY since that date, form an epitome of surgical progress in this country. There are two years in the handwriting of the great Doctor McBurney, eight years in that of that charming gentleman and sportsman, Dr. LeRoy Milton Yale, followed by Dr. Frank Hartley, that brilliant genius in our art, then Drs. Andrew McCosh, Frank W. Murray, Lucius W. Hotchkiss, etc., etc. Occasionally there is a certain element of amusement in the proceedings. At one of the earlier meetings Doctor Bull read a paper on hernia. At the meeting before he read the paper he made a motion that a young surgeon, Dr. W. B. Coley, who had assisted him in its preparation, be invited to be present and discuss the paper. The motion was lost.

I realize that in attempting to cite some of the more important papers and discussions, which to me seem to have contributed to progress in surgery, I shall commit many sins of omission. I shall attempt of course only to touch the high spots and shall miss many of them, but I hope Mnemosyne will remember my prayer. I shall omit most of the interesting business meetings, where the dues were raised from one dollar to five and then to ten dollars, and then reduced to five again, the gradual enlargement of the membership from twenty to twenty-five and so on to the present number as the city expanded and the work with it, and the troubled question of publication, which finally came to a most satisfactory settlement with the ANNALS OF SURGERY and

Dr. Lewis Pilcher, who is here with us tonight. I was filled with pride by the account of the meeting held November 9, 1892, in which a motion was made that the five leading journals of the country be invited to send reporters to the meetings and that notices of the meetings be sent to such journals. On looking at the list I saw that "Lo, Ben Adhem's name led all the rest" for the first on the list was the Boston *Medical and Surgical Journal*, upon which I was soon to enjoy the position of Assistant Editor. The remainder of the list consisted of the *Medical News* of Philadelphia, the *Journal of the American Medical Association*, the New York *Medical Record*, and the New York *Medical Journal*.

At a meeting in the late eighties Doctor Wyeth moved that "a transcript of the proceedings of the Society be sent to every medical journal in the country." The motion was lost.

I know who attended the meetings and who did not, who had to be disciplined and who did not, but, as far as I am concerned, the facts shall remain a profound secret. I am not a modern muckraking historian. There were all sorts of salutary regulations about losing one's membership if one did not read a paper once in so often, and attend a certain percentage of meetings, which must have tended to keep the members up to their work and have helped toward the remarkable success of the Society.

After several years of meeting in the Governors' Room of the New York Hospital, the Society began to meet in the old Academy of Medicine and now I presume enjoys the luxurious surroundings in which we are meeting at present.

I think perhaps the most interesting way to take up the contributions of some of the members to the surgery of the period will be to speak of them in connection with the subjects of discussion at what seem to be the more important meetings.

This Society was begun just at the time that operations for appendicitis were beginning to be done. Although Boston can claim to be the birthplace, so to speak, of appendicitis, it was Charles McBurney, of New York, a founder of this Society, who gave special attention to the refinement of diagnosis and operative technic. McBurney's point and the McBurney incision became bywords. In regard to appendicitis there were noteworthy meetings. At the fifteenth meeting, in 1880, Doctor Sands read a paper on perityphlitis. On March 3, 1888, Doctor McBurney reported a case of perforation of the vermiform appendix in which two calculi (sic) were found in the appendix. On October 23, 1889, Doctor McBurney's paper was entitled, "Experiences in the Early Operation for Abscesses of the Vermiform Appendix." Doctor McBurney's work on the appendix was not the only contribution he made to surgery. In 1891 he removed a gall-stone through the duodenum, he suggested the compression of the femoral artery through an abdominal incision in amputations, his were the brains and interest that built the Syms operating theatre at the Roosevelt Hospital and, in connection with the manufacturers, developed the modern pressure sterilizer.

Doctor Bull bore the same relation to hernia that Doctor McBurney did to appendicitis. The relations of the Society to the development of the subject are illustrated by a paper by Doctor McBurney, a case of radical cure of hernia in March, 1888.

In 1882, the Society had a discussion on Heaton's method for the radical cure of hernia. I wonder how many students of our day remember what that was. Suffice it to say that Bull and Weir reported forty-one cases with fourteen recoveries. This blind procedure, as well as McBurney's open method, McEwen's folding of the sac, etc., have all gone into the scrap heap, but they were all steps in the progress which has brought us up to the present, and will continue into the future. Notable papers by Doctor Bull were: March 25, 1891, "Notes on cases of hernia relapsing after various operations for radical cure" and "Notes on the mechanical and operative treatment of hernia" in 1893.

Doctor Stimson's contributions to the early meetings included, in 1880, "A case of ligature of the carotid and subclavian for innominate aneurysm." Of course, he was a constant contributor on fractures, and reported many operations on fracture of the patella, which in the early days caused so much discussion. How long ago that seems. Doctor Stimson was also one of the first to ligate the ovarian and uterine arteries in removal of the uterus, in January, 1889. I remember well a visit of his to the Massachusetts General Hospital in Boston about 1892, when he spoke on the ligature of the arteries in hysterectomies, which soon displaced the antiquated and barbarous procedure of the wire around the stump which was left outside to slough, another of the unhappy memories, with which we are glad our younger brethren are unacquainted. Doctor Stimson illustrated all sorts of subjects and was a really great writer on surgical themes. In 1889, he made the following shrewd observation on a case of fracture of the clavicle, with dislocation of the costo-chondral joints of several ribs. "In these cases he had noticed a change of color over the chest and face, and in some cases with hæmorrhages into the cavities of the body and about the eye. The discoloration he thinks is not due to the extravasation of blood. The patients are so dark that they may be mistaken for negroes. This is due to the blood coloring matter, but how is not known,"—a good description, of course, of what we call traumatic asphyxia in our textbooks.

Doctor Weir's early labors in perforation of the stomach, we all remember. Doctor Weir was an intense worker in the field for many years and many were the contributions made by him to surgical knowledge. The first meeting of the Society was held at his house and as early as the fourth meeting, namely, December 9, 1879, he reported a case of "Cystic degeneration of the appendix vermiformis." I well remember his presiding over the surgical section of the American Medical Association in Boston in 1902, and his impressive presence, piercing eye and noteworthy comments on the papers.

In 1892, Doctor Lange, filled with scientific enthusiasm, moved that the Society purchase a microscope. A committee of one was appointed to see if the Academy could furnish one to the Society.

As early as 1889 Doctor Abbe was writing on vegetable plates in intestinal obstruction. In 1884, at the seventieth meeting, Doctor Halsted reported the removal of a human tooth from a man's hand with the statement that "the evidence was agin him."

In November, 1892, Doctor Coley spoke on Bassini's operation for hernia. Ever since then, here and there through the transactions, may be found his contributions to this subject. In connection with Doctor Coley, the following note is of interest, "March 25, 1896, report of a committee consisting of Doctors Stimson, Gerster and Curtis, on the treatment of malignant disease by erysipelas toxins." The method was strongly condemned. That the effect of this condemnation was not permanent may be seen from the contributions by Doctor Coley on the subject which are scattered through the reports of the Society ever since. In fact, it may be said that Doctor Coley's contributions to the treatment of bone sarcoma have been a very important part of the work of the Society.

One cannot forbear to mention the valiant work of Dr. Willy Meyer on the surgery of the chest, and his construction and use of the Sauerbruch Cabinet. Although the cabinet has been replaced by the intratracheal method of Meltzer, also a product of New York, its construction and use required a lot of labor and enthusiasm, and was a step in the right direction. Doctor Meyer was also a pioneer in the modern operation for cancer of the breast and many other subjects.

On May 11, 1910, Doctor Lilienthal reported the first human thoracotomy under intratracheal anæsthesia. The remarkable achievements of Torek and Lilienthal in the successful removal of cancers of the œsophagus were directly due to this wonderful device of Meltzer.

As early as March 23, 1888, Doctor Lange reported a gastro-enterostomy for carcinoma of the stomach, which is the first report of this operation that I can find in the records. Later, Doctor Brewer, in collaboration with Doctor Cole, röntgenologist, contributed to our knowledge of gastric surgery. His work, too, marked a step in the progress of our knowledge of infections of the kidney, and for many years he was a constant and enthusiastic contributor to the Society's proceedings.

On December 14, 1904, it was moved that the Society celebrate its twenty-fifth anniversary by giving a dinner, to which the original members be invited as guests of the Society. The dinner was held, as may be inferred from the note that at the meeting on February 8, 1905, the treasurer's report on the anniversary dinner was read and approved. But alas, the dinner was not reported in the secretary's minutes. Perhaps some of the members here tonight can tell us about it, for since then all the original members who might have been present then have gone to their reward.

On November 11, 1908, Doctor Erdmann was writing on "Acute Hemorrhagic Pancreatitis."

In 1910, Doctor Woolsey on "Transfusion for Pernicious Anemia." Of the many contributions of Doctor Woolsey to the Society, over a long period, I have not time to speak, except to mention an early case of suture of gunshot wound of the intestine.

In regard to the surgery of the thyroid, the first mention of it I found in the Society's proceedings was on May 22, 1889, when Frank Hartley spoke on the "Operative treatment of Struma." "Doctor Lange had seen a case of secondary hæmorrhage following the operation." Doctor Lange was not the only one who in those early days had seen this.

On November 23, 1892, Dr. B. F. Curtis reported the successful removal of a tumor of the brain.

In 1910 Doctor Woolsey presented the subject of "Transfusion for Pernicious Anemia."

In the scanty notes that have preceded, nothing has been said about the development of prostatic and genito-urinary surgery, although Doctor Keyes was one of the original members of the Society. We all remember J. William White's orchidectomy, etc. In 1892 one of the prominent members of the Society reported a ligation of both iliac arteries for hypertrophy of the prostate followed by ligation of the left common iliac for secondary hæmorrhage from the external wound, caused by pressure of forceps on the internal iliac. The prostatic hypertrophy had certainly disappeared six months after the operation. The present safety of prostatectomy certainly contrasts with the dangers which in the early days made the attempt of difficult and indirect methods justifiable.

In January, 1911, Doctor Gerster reported on splenectomy for Banti's disease.

On October 25, 1911, Doctor Kammerer reported a complete removal of the larynx, thyroid gland and six inches of the œsophagus for cancer; no recurrence after six months.

About this time meetings were beginning to be held at the various hospitals. At some of those meetings the programs were really tremendous. Often twenty or thirty cases would be presented and discussed, in addition to the paper of the evening.

On April 19, 1913, the membership, which had been during the years gradually increased, was brought up to sixty.

On November 25, 1914, Torek presented his wonderful case of resection of the œsophagus for carcinoma; well twenty and one-half months after operation.

In 1913, Weir again presented the subject of perforations of the stomach and Moschcowitz made his contribution to the subject of sliding hernia. At this time Alfred S. Taylor had something to say about Erb's paralysis. Syms spoke of lymphangioplasty by Handley's method. Joseph Blake read a paper

on splenectomy for Banti's disease. The subject of Doctor Blake's contribution brings up the subject of the part taken by the members of the New York Surgical Society during the war and the important place which Doctor Blake's sanity, brilliance and enterprise gave him in the treatment of fractures, simple and compound, in the military service. Of the units headed by Brewer, Peck, John Walker and others, and the services of Pool and many other distinguished men of this Society as consulting surgeons, the New York Surgical Association certainly may be proud.

I have said nothing about the remarkable work of Burton J. Lee, at the Memorial Hospital, on cancer and the treatment by radiation. I have not entirely forgotten Carrel—who could?—and the absolutely incalculable lives he saved by his introduction of the Carrel-Dakin treatment during the war, or his no less miraculous work in the suture of arteries, making possible the transplantation of viscera, and the cultivation of living tissue in vitro.

Elsberg's work on tumors of the spinal cord must not be forgotten nor the contributions of Lyle to the difficult field of the surgery of the hand in industrial accidents.

In 1919 Chas. H. Peck was president of the Society and on October 9, 1918, read a paper on "Hospitals of the American Expeditionary Forces."

In 1920 Burton James Lee spoke on the "War's Contribution to General Surgery."

To one who has constantly read the proceedings of the New York Surgical Society and the Philadelphia Academy of Surgery, it was an event of great interest when the two societies in recent years began to combine their meetings. Think what a galaxy of talent that produced! The combined meetings have constantly been successful and the combination of two points of view has perhaps often brought us nearer the truth.

If I might characterize the prevailing temperament of the New York surgeons I have had the privilege of knowing, I would say that they were characterized by indomitable enthusiasm and energy, and sincere love for their profession, qualities which it is easy to see are most favorable to progress.

Nothing has yet been said about the influence of the members of the New York Surgical Society in the work of the American Surgical Association and the other great surgical and medical associations. The sharp debates, the acute criticism and the surgical enthusiasm which has been fostered by this Society, has enabled them to take a leading part in the proceedings of the Surgical Association, and numbers of its members, many of them who have been mentioned in this address, and many of whom are here in person, have served as presidents, secretaries and other officers of the national association.

In the eleven years since the war, the work of the Society has gone on with undiminished activity. Doctor Lilienthal has made many contributions to thoracic surgery; Dowd, Matthews, Pool, Walton, Martin, Downes, St.

John, and others, have taken with undiminished brilliancy and success the places of those who preceded them in the active work of the Society. Gibson has done valiant work as introducer and sponsor of the follow-up system, and has made many other valuable contributions to our art. Whipple has contributed on omentopexy and splenectomy in cirrhosis of the liver, on cancer and pancreatitis and upon many other subjects.

You will notice that there is one man whom I have not mentioned, a former president, Dr. Ellsworth Eliot, whom I craftily left until the last, because I wanted to leave a good impression on his mind, since he is the only one who has an opportunity to reply to what I say. Suffice it to say that he has been for many years a frequent and valued contributor to your meetings as well as to those of the American Surgical Association, of which he was president last year. The subjects on which I remember him best have been intestinal obstruction and the surgery of the gall-bladder. His work has been characterized by intelligence and judgment. He is a friend of long standing and has gone out of his way to be kind to me in the past. I fear the less his reply.

Among the earlier members of the New York Surgical Society was Arpad G. Gerster, first surgeon in chief of the Mt. Sinai Hospital when it was new, also surgeon at the German and other hospitals. He was a president of this Society, and of the American Surgical Association. An immigrant to this country, he came here with qualities of heart and head which few of us possess. He was a thorough classical scholar. He loved learning, he loved nature, and he loved God. He was an ardent hunter and, especially, fisherman. I used to meet him on some of his fishing expeditions with the late Dr. LeRoy M. Yale, your second secretary. He loved many forms of sport, rode a horse, rowed a boat, and explored Long Island Sound in his canoe. He wrote the book on "Aseptic Surgery" which was our guide in practice during many years. He exemplified the saying of the great Hippocrates that where there is the love of man, there is the love of the art of medicine. "None knew him but to love him, none named him but to praise."

On looking through the precious records of the Society I found in the back of one of the volumes a little sketch, marked in the lower right-hand corner, "A. G." and in the lower left-hand corner, "Surgical Society, March 22, 1893." Doctor Gerster presided at that meeting. It was evidently made on a scrap of scratch paper either to keep him awake, or enable him better to endure the tedium of the paper of the evening, which was on the subject of cholecystitis, and by a very eminent surgeon of that day. But it illustrates the things he had in his mind and heart that helped him through the long grind and hard work of his practice. He did love his play. He was skilled with his pen and brush. Whether it is a portrait of his camp on Lake Raquette (where he had one) or not, I do not know. But it reminds one of the fact that even at meetings of the New York Surgical Society, the mind of its president might be elsewhere attending to what was for a lover of nature

and of beauty the real business of his life. Said Schiller: "To speak out once for all, man only plays when in the full meaning of the word he is a man, and he is only completely a man when he plays. Schiller: Essays Aesthetical and Philosophical. And if the ghost of Lord Byron will forgive me, I will paraphrase a few famous lines of his about a gladiator:

> He heard it but he heeded not—his eyes
> Were with his heart and that was far away.
> He recked not of the learning lost nor prize,
> But where his rude hut by the Raquette lay,
> There where the trout and salmon leap and play,
> There where the sunset's glowing robe of fire
> Tinges the dark blue wavelets of the bay.

Among the many omissions in this address have been references to the invaluable services of the members of the Society in the teaching of surgery. Suffice it to say that the majority of them have been, and are, professors in the great medical schools of New York, and many have devoted a large part of their lives to the teaching of their art to students of their profession. There is no finer way to pay our debt to those who taught us the art, than to pass on their teaching, enlarged and modified by our own experience, to those who are to follow in our steps. This in overwhelming measure the members of this Society have done. And now the time has come to bring to an end my discourse, again commending it to you with reference to my opening petition. To the future, this Society may look with hope and confidence. Suffice it to say that if the same enthusiasm, sound sense and energy shall continue to animate the Society that have characterized it in the past, the future will not be unworthy of that which has gone before and we may well say to the Society, now fifty years young, and proud of the accomplishment of every year, in the words of the great Latin poet whose two thousandth anniversary will be celebrated within a few months of its fiftieth milestone, *"Macte nova virtute, puer, sic itur ad astra."*

Remarks of PRESIDENT BEER, introducing DR. WILLIAM J. MAYO:

There are few clinics in the world that are more hospitable to new ideas and to visitors than the Mayo Clinic at Rochester. Dr. William J. Mayo made it a practice to visit New York City for long periods over many years when he was a young man and thus had the opportunity to come into contact with many of our original membership. I love to think his reception by our founders may have contributed to the development of the hospitable atmosphere of the Mayo Clinic. In view of his intimate relations with so many of our earlier members, I know of no one better fitted than he is to dwell on the more personal side of New York City's eminent surgeons during the first thirty years of our activities. It is a privilege and a great pleasure to introduce to you Dr. William J. Mayo, who will address us on his "Personal Reminiscences of the Members of the New York Surgical Society."

EARLY DAYS OF THE NEW YORK SURGICAL SOCIETY

By William J. Mayo, M.D.
of Rochester, Minnesota

The New York Surgical Society was organized fifty years ago by a group of surgeons in New York who were actuated by the desire not only to advance the science and art of surgery, but to develop character in its members, and by example as well as precept to encourage right thinking in the many surgeons of foreign extraction who perhaps had accepted a viewpoint of professional ethics which was not like-minded with American ideals.

New York was and is the great metropolis of America, the entry port for that enormous immigration from foreign countries which, in the later decades of the nineteenth century admitted to our shores, with the great masses of desirables, many undesirable immigrants. One notes that when the American Surgical Association was organized in 1880, among its charter members were many of the men who had organized the New York Surgical Society the year before, the ideals of whom were embodied in the American Surgical Association.

The conditions of medical practice in the United States in the early days were interesting. In the "History of Medicine," by Colonel Garrison, one will find valuable historical data. Dr. J. M. T. Finney, in his Hunterian Lecture (January 17, 1927); has traced the influence of John Hunter on American surgery and has given an enlightening perspective of surgery in the United States in colonial times.

The three cities in which scientific medicine had its chief habitation in the early days were Philadelphia, Boston and New York.

In Philadelphia was the Philadelphia Hospital, the first hospital established in the United States. The College of Physicians of Philadelphia, the University of Pennsylvania, and the Jefferson Medical College, working together with a degree of unanimity which was most praiseworthy, enabled Philadelphia to play a great part in the development of scientific medicine in our country. I will not at this time do more than mention the Grosses, father and son, the Pancoasts, Agnew, Ashhurst, and other men of the nineteenth-century construction period, men who established ideals and standards which are still maintained in Philadelphia.

In Boston, the faculty of the Harvard Medical School and the men connected with the Massachusetts General Hospital and the City Hospital exercised an influence equal to that of the Philadelphia groups in maintaining the highest standards of the medical profession. The influence of the distinguished New England group, the Warrens, the Cabots, Bigelow, Nathan Smith, Charles B. Porter, John Homans, and Maurice H. Richardson may

be mentioned. Philadelphia and Boston were developing an American surgery largely on the British concept.

New York was cosmopolitan. Its population was already showing signs of cleavage into groups influenced by their origin and ingrained habits of mind and training. The increasing differences in thought and practice made the organization of the New York Surgical Society in 1879 necessary for proper development of sound surgery. We must also take into consideration the great advances in medical science which were brought about by the discoveries of Pasteur, and their application by Lister in the latter half of the nineteenth century, which was destined to remake American surgery.

It is interesting to visualize the three great European schools of surgical thought that so greatly influenced American practice.

The Latins, as exemplified by the French, because of the rapidity and accuracy of their mental processes, are leaders of intellectual life. No people in the world with whom I am acquainted have the same power of almost instantaneously marshalling their knowledge and converting it intuitively into wise action. Pasteur's work was of more value to the human race than that of any other man who ever lived. The names of those who did great work in the field of modern French surgery are too well known to make mention necessary; yet one must speak of Péan, Tuffier, Hartmann, and Championnière. Langenbeck studied in France, and carried home with him the foundation of Germanic surgery.

The peoples of the Teutonic nations have a gift for gathering accurate information, encyclopædic in its nature. If one wants to know all about a subject, he will find that the Germans have all the data, staggering and sometimes even confusing in the wealth of detail. From this nation came Virchow. The Teutons early accepted the teachings of Lister, and in fact Semmelweiss, a Hungarian, was the first exponent of Listerian methods in continental Europe.

The new régime produced in Germany men of the most extraordinary distinction, Langenbeck, Volkman, Schede, Trendelenberg and von Esmarch, to name only a few, and in German Switzerland, Kocher.

In Austria were Billroth, and that famous school of surgeons who followed him, of whom von Eiselsberg and Mikulicz are outstanding.

British medicine by tradition and language is closely related to American medicine. England, sound, solid, and conservative, is the home of clinical investigation. Always is the patient the compass which guides medical science, and clinical investigation thus guided brought Lister to undying fame.

In Scotland the scientific study of anatomy and physiology is at its best. I have never seen more beautiful dissections than those made by Scottish surgeons, the gift of their careful anatomical training.

Wales gave us Robert Jones, with whom began modern orthopædic surgery, in its best sense.

Ireland has taken an extraordinary part in medical advancement. The

Rotunda Hospital, in Dublin, for example, to which our knowledge of obstetrics owes so much, demonstrates the conspicuous position of Ireland in medicine.

Scientific contributions from England, Scotland, Wales and Ireland go to make up British surgery. Add to these diverse gifts those from Canada, Australia, New Zealand, and South Africa, and one gets an idea of the richness of medical science and art of Britain as a whole.

The men on the staffs of the hospitals of Great Britain have always been distinguished for their contributions to medical science. The thought of Guy's Hospital, London, for example, brings many honored names to mind. It was here that Belchier introduced the injection of madder dye into the vascular channels in the cadaver, a procedure which enabled the Hunters to do their great work on the lymphatic channels, second only to that of William Harvey in the discovery of the circulation of the blood.

Richard Bright, working at Guy's, in 1828, accurately described acute nephritis in its relation to albuminuria, clinical investigations carried out with the aid of a tablespoon, nitric acid, and a candle, and from necropsy examinations, and in 1838 described the granular contracted kidney of chronic nephritis. Addison in 1849, in a few short pages, gave that graphic description of pernicious anæmia which has stood the test of time, and, in 1855, described the syndrome related to the suprarenal glands which carries his name. Hodgkin here accomplished his work on lymphadenoma, the exact nature of which is still in dispute. Hilton, while at Guy's, wrote his extraordinary work on rest and pain, which my father said was the most illuminating book of its kind he ever read. Hilton Fagge wrote the only "Practice of Medicine" that I have ever studied which compared with that of Osler. One can turn to its pages and find quickly clinical investigation corrected by necropsy data.

I have always considered Jacobson's "Operations of Surgery" the greatest work on operative surgery which I ever studied. Sound and sane, it covered the salient features of anatomy and physiology, and with wise caution indicated the peculiar procedures which would be best suited to meet individual conditions. I owe Jacobson much.

Changing conditions in medical education brought into New York not only men who had been educated abroad, but also many Americans who had spent one or two or more years in European countries, and had brought home with them knowledge which they had gained by their training abroad.

The new surgery was established perhaps more quickly in New York than in any other place in the States. Arpad Gerster (1873), and Fred Lange (1879), both of New York, and both members of the New York Surgical Society, and Christian Fenger of Chicago (1877), all educated in Europe, were the leading exponents of aseptic and antiseptic surgery in the United States.

I was graduated from medical school in 1883, when I was twenty-one years of age, and I first went to New York City in the autumn of 1884.

Thereafter, each year for several years, I spent six or seven weeks in New York, as did my brother, Charles. My first course was at the New York Post-Graduate School in 1884; the next in the New York Polyclinic, in 1885.

Of the many fine teachers in the New York Post-Graduate School in 1884 with whom I came in contact, I remember best Dr. James L. Little, a member of the New York Surgical Society. Doctor Little was a large, handsome man, with a white beard, and hair somewhat scanty on top. He always looked well groomed. At that day tobacco was chewed more than at present, and I have seen some worthy practitioners of years ago whose beards bore evidence of the fact. Professor Little was immaculately clean. His hair and beard fairly shone, and his face was pink rather than congested, as were the faces of so many men in those days from the use of alcoholic beverages.

Antiseptic surgery was attracting the attention of a few American surgeons, but generally speaking, the surgery at that time was the surgery of necessity. Operations of expediency were done but rarely. Professor Little was just beginning to be influenced by the teachings of Lister. His results were excellent, because, as was said of Lawson Tait, he was so clean naturally.

But the surgeon of that time who impressed me most was Dr. Henry B. Sands. Doctor Sands was a small man, with a gray moustache, and scanty hair on the crown of a splendid head. He wore glasses, and when talking often unconsciously removed and polished them. He was the first president of the New York Surgical Society. Sands started in medicine as an ophthalmologist and changed over to general surgery. He became the chief surgeon at the Roosevelt Hospital, where there was gathered around him a brilliant group of younger surgeons, most of whom now, unfortunately, have passed on: Charles McBurney, Frank Hartley, Robert Abbe, and William T. Bull, all members of the New York Surgical Society. In witnessing Sands' work, therefore, I early became acquainted with these coming master surgeons, whose great careers were just before them. I have always had a most kindly feeling for Sands as a man, as well as great admiration for him as a surgeon.

The small amphitheatre of the old operating room at the Roosevelt Hospital was circular, and suspended, so that one went by a little passage into an outlook from which one had a view almost directly down on the operating table. The clinics at the Roosevelt Hospital began at two o'clock in the afternoon, and I was always there at one o'clock in order to secure a favorable seat. The clinics were often prolonged, and sometimes it was half-past six or seven o'clock or later before they were completed, but there I sat. At the close of a long day an orderly had brought Doctor Sands a message, and as he received it, he looked up and saw me still sitting in the amphitheatre. He said to me in his friendly way, "I see you sitting here through every clinic. You can go away, but I must stay until my work is over. They tell me that there is an interesting case out in the surgical ward. Perhaps you would like to go with me." I certainly would like to go with him, and I went.

In the ward was a man with a swelling in the right iliac region, very ill,

with fever and vomiting. After asking me to examine the patient, Doctor Sands said, "I believe we have here a perityphlitic abscess described by my old teacher, Willard Parker. These abscesses rupture sometimes and cause fatal general peritonitis. I do not know why this region should be so susceptible to these foul abscesses. We will give the patient a little chloroform and open the abscess here in the ward." He opened the abscess and put in a drain and then said, "I never like to squeeze an abscess to get the pus out because it may injure the protective wall about the collection of pus. If there is free drainage the pus will run out fast enough. I have noticed that if one is in too much of a hurry to empty an abscess one will often get a little blood and the patient will not make so tidy a recovery. Washing an abscess out seems to delay healing; perhaps thinning the pus makes absorption easier. Nature seems to take better care of such abscesses, if the drainage is good, than we can by anything we can do."

Doctor Sands asked me whether I had ever seen cases of this kind, and I said that I had. I had seen my father operate in several cases in which there were foul abscesses of a similar nature. I told him that one little trick my father had was to use a large hypodermic syringe with a large needle which he introduced to locate pus. He never removed the needle, which he used as a guide, until he cut down on the abscess, because, he said, he formerly had introduced a syringe without retaining the guiding needle, for various types of abscess empyema, abscess of the liver, and comparable conditions, and had not always been able to find his way into the abscess again. When I told him this, Sands laughed. "I have often been in exactly the same fix. It is a good idea." It is still a good idea.

In 1885 when I returned to New York for study, John A. Wyeth, a member of the New York Surgical Society, was at the head of the New York Polyclinic. He was a southerner and had served in the Civil War with the great cavalry leader of the South, Forrest, for whom he had ardent admiration. He was an excellent surgical anatomist and did noteworthy work on the surgery of blood vessels. An easy, fluent speaker, and a man of attractive personality, he nevertheless was not popular with the New York surgical profession; whether this was a result of the feeling aroused by the war, I do not know. He was President of the American Medical Association in 1902.

At the New York Polyclinic I came in contact with the man who I believe did more for American surgery as a whole than any other man of his time. Without discussing here his great experience and skill as a surgeon, Arpad G. Gerster, a member of the New York Surgical Society, brought to America aseptic and antiseptic surgery, which he carried out at the Mt. Sinai Hospital. I have always been rather pleased that in one of the photographs taken by Gerster which went to make up that splendidly illustrated volume, "Aseptic and Antiseptic Surgery," I appear among the bystanders. This book of Gerster's went through three large editions, but he never revised it. When I came in after years to know him well, and asked him about it, he said, "I

wrote all I had to say at that time." Gerster was a Hungarian, although of Swiss descent, and he had been trained in the Teutonic school of surgery.

At the same period Frederick Lange, a member and founder of the New York Surgical Society, was working at the German Hospital and teaching, as Gerster did, the principles of aseptic and antiseptic surgery. Lange did not write much. Because he did not speak distinctly, he was only a fair teacher, but no one could attend his clinics without the greatest benefit. He retired to Germany before the Great War.

Christian Fenger, of Chicago, was a Dane. Like Sands, he was trained as an otologist and ophthalmologist, and would have been made head of the department at the University of Copenhagen if it had not been for his defective speech. He went to Egypt and from there to the United States. In Chicago he did for modern surgery what Gerster did for it in New York.

My brother and I soon established an acquaintance with the New York hospitals and New York surgeons which enabled us to choose the men who could give us the most. The intention was to travel each year for a certain length of time, first at home and then abroad, to study a particular subject under the masters of that subject, and then to take courses in surgical anatomy or physiology or whatever was necessary to enlighten us further. It is a great mistake for a man to go to one clinic after another without making a real study of any one. This course leads to general information, but it is often so confusing in the mass of detail that a surgeon cannot go home and put into practice the things he has learned.

I confined myself very largely to the Roosevelt, the New York, Mt. Sinai and Presbyterian Hospitals, sometimes going down to the Bellevue Hospital. The great work done by Charles McBurney, a member of the New York Surgical Society, in the early time, at the Roosevelt Hospital, on appendicitis, which Reginald Fitz of Boston, in 1886, was the first to describe, and the McBurney operation, for removal of a stone implanted in the terminal end of the common duct, were two of the many scientific contributions which added to McBurney's great reputation.

William T. Bull, a member of the New York Surgical Society, down in the old Chambers Street Hospital in New York, performed the first successful operations for gunshot wounds of the intestine. One of the celebrated surgeons of the time said that his success was a misfortune because it would lead other less able surgeons to make disastrous and hazardous attempts. Bull, like Dr. Maurice Richardson, of Boston, had few equals in surgical judgment.

Frank Hartley, a member of the New York Surgical Society, was one of the most gifted surgeons in New York, but for various reasons he never came quite up to the expectations of his many admirers.

Robert Abbe, a member of the New York Surgical Society, did most notable work in that early time, especially in intestinal surgery, stressing particularly, as I remember so well, the long lateral anastomosis for intestinal obstruction.

In the New York Surgical Society was one man, William S. Halsted, who

was to become famous as a teacher of surgery at the Johns Hopkins Medical School. Halsted has the distinction of having developed more surgeons than any other man of his time in America. He was a great writer and a great investigator.

At the New York Hospital were many brilliant men, of whom the leader at that time was Robert Weir, a member of the New York Surgical Society. Weir had an original mind and surgical imagination, and was a leader in advancing the surgical frontier.

I became a fellow of the American Surgical Association in 1899 when Weir was president of the organization. His presidential address in 1900 was on acute perforations of the duodenum, and his striking presentation of cases, and clear descriptions in relation to the pre-perforate symptoms which we now know to be those of chronic duodenal ulcer, impressed me greatly. They were graphic; they caught my imagination. When I came home I had several patients with acute perforation of the duodenum who gave pre-perforative histories almost identical with those in Weir's cases. I was encouraged to operate on some of the more serious chronic duodenal lesions, and was soon able to recognize and separate the chronic duodenal ulcer from the chronic gastric ulcer.

Lewis A. Stimson, a member of the New York Surgical Society, who wrote the splendid work on fractures and dislocations, was also on the staff of the New York Hospital.

At the Presbyterian Hospital, I remember best Andrew J. McCosh, a member of the New York Surgical Society. McCosh was one of the soundest surgeons in New York. I came to know him quite intimately and traveled abroad with him. His unfortunate death occurred in 1908 as the result of an accident with a runaway team of horses.

Virgil P. Gibney, a member of the New York Surgical Society, was one of the first Americans to carry sound surgery into the field of orthopædics, in a day when orthopædic treatment was largely a matter of concealing deformities by hanging on apparatus, and it was considered a good result when a patient eventually could escape from the hands of the surgeon in no worse condition than when he started.

Joseph Bryant, a member of the New York Surgical Society, of Bellevue Hospital, was an excellent lecturer and came into a great deal of prominence because of the operation that he performed, with W. W. Keen, on President Cleveland. Bryant was afterward President of the American Medical Association in 1907.

I have been greatly saddened by the death of Charles H. Peck, an intimate friend. Doctor Peck was a sound surgeon, a member of the New York Surgical Society. His life was blameless and his example one to be emulated. It would be idle for me to speak further before this association of one of its most loved members, whose personality and scientific work are so well known to you.

Time prevents my referring to many other men who did notable work.

I have always been grateful to the surgeons of New York, and wish here to acknowledge the aid and inspiration they gave me. And I have been thankful for the opportunities which I had of attending meetings of the New York Surgical Society. At first the meetings were held privately; fortunately, later, they were made accessible to visitors.

I shall not speak of the living members of the New York Surgical Society, but as I look around this audience it is a satisfaction to see so many men to whom I am indebted for surgical teaching and whose friendship I value highly.

Remarks of PRESIDENT BEER, introducing DR. ELLSWORTH ELIOT:

The next speaker on our program, one of our own members, has had the unique advantage of working with many of our original members, and many of the present active members have profited by the teachings that he has passed on to them from his early experience. Last year he was President of the American Surgical Association, and some years ago was president of this organization. He has always stood for the best in surgery and for high ethical standards. We look upon him in these matters as firm as the Rock of Gibraltar. It gives me the greatest pleasure to present Dr. Ellsworth Eliot.

THE SEMICENTENNIAL ANNIVERSARY OF THE NEW YORK SURGICAL SOCIETY

By Ellsworth Eliot, Jr., M.D.
of New York, N. Y.

Doctor Lund has recalled the faces and the figures, and Doctor Mayo has faithfully portrayed the character of many of the original members of this association whom it was the privilege of a number of those present to love and admire. This Society certainly was conceived under very unusual conditions. New Amsterdam, afterward New York, was always cosmopolitan. Situated between Boston, the hub of culture and of intellect on the North, and Philadelphia, the centre of intellect and culture on the South, this city soon lost whatever advantage it may have enjoyed from priority of birth, and it was not until the 19th Century was well along that it was again equal in numbers, if not in the quality of its population, to its neighbors.

One is rather apt to believe that the New York of to-day has not changed materially from the New York of the past; and in one particular this is true. New York has always been favored by representatives of many nationalities. In the old days of past generations we spoke of the Thompson Street negro, of the Italian of Elizabeth Street, of the Hebrew of Hester Street, and of the Chinamen of Mott Street. To-day these foreign nationalities of many lands are still represented here, though in different parts of the city, with the exception of the Chinaman who still inhabits Mott Street and has made that thoroughfare aristocratic.

The pedestrian on Fifth Avenue, as he wanders up Murray Hill, can scarcely realize that between 36th and 37th Streets the level of the Avenue is at least 20 feet below what it was originally, and perhaps some of you can remember the frame house and the florist shop on the eastern side of this portion of the Avenue, to the top of which outside a flight of wooden rickety steps led. The corner lot adjoining, now occupied by Tiffany, was vacant and in it we played baseball. Further up on Fifth Avenue, beyond and opposite to the reservoir, was another landmark; a two-storied frame house with a large willow tree on the edge of the sidewalk, and on the corner, adjoining, the fashionable Fifth Avenue market. The site of the present Savoy-Plaza Hotel was occupied by an extensive marsh, and years ago, one of the older managers of the Presbyterian Hospital told me that this was a favorite hunting ground for him and his friends, who shot birds in the brush on its edge. Above 59th Street, Manhattan Island was practically a wilderness. In looking over one of the books of the County Medical Association recently, I counted the number of doctors who lived on the West side of this portion of the city and found less than ten. It was known familiarly as "The Rocks," incapable of any extensive development. Now and then the City or a property owner would excavate a building plot or street by blasting away

with successive charges of powder the rock foundations. A somewhat larger number of doctors lived on the East side in "Yorkville," now 86th Street, for through this region the old Boston Post Road extended upward to divide near the Harlem River for Boston and Albany. The larger population was also accounted for by the greater fertility of the soil.

With this primitive condition the hospitals of the city closely corresponded. The two oldest hospitals were Bellevue and New York, both long established. For a number of years in the eighteen-seventies, the latter hospital was closed when it changed its location, the original building on lower Broadway having become infected with uncontrollable erysipelas. Presbyterian, Roosevelt and St. Luke's Hospitals, in their infancy, were geographical expressions rather than actual entities. Bellevue, even then, was political and democratic, while New York Hospital was aristocratic, and for a long time only members of New York's leading families were admitted as internes to its house-staff. I remember as a medical student talking with a friend who had succeeded in being appointed an interne to this hospital. He had just imparted this important information to a classmate and had met the rejoinder "Gee! but you must have had a pull!" The attending staffs of these hospitals were like so many interlocking directorates; no member had a continuous service. The maximum length of service during each year did not exceed three months and many had shorter periods. There were no assistant or associate surgeons and the fortunate candidate, when first appointed, was obliged to step from an inconspicuous dispensary position into the acutely active service of a ward. Members of the Medical Board were not only surgeons but general practitioners as well and did not refrain from indulging, even, in the practice of midwifery. One of the early presidents of this Society, connected with the New York Hospital, enjoyed a great influence in its conduct, which was ascribed to the fact that in the course of his fifty years of service he had delivered all the members of the Board of Trustees.

Now came the magical wand of Pasteur and of Lister and the birth of a new surgical era. It was precisely at this time that the New York Surgical Society came into existence, enthusiastic and eager to promote the advance of what was essentially a new science. Not without certain doubtings and arching of the eyebrows was antiseptic and afterward aseptic surgery placed on a sure foundation, a triumph for which, in this city, none deserve more credit than the original members of this Society. The marvelous advance in surgical technic left scarcely any organ or body cavity intact. The brain, the spinal canal, the thorax, the abdomen and pelvis and the genito-urinary organs were all included in the surgical domain. Then came the inevitable specialist who, one after another, appropriated the different surgical fields, in which even his medical colleague participated, who claimed the surgical treatment of empyaema. The justly celebrated internist, Francis Delafield, described in his didactic lectures the technic of incision and drainage with or without the excision of a rib for the relief of this condition. He emphasized the need of always operating with the patient in a sitting position, without a

general anæsthetic and advocated opening the abscess through a single incision and thereby avoiding infection of the thoracic wall which was certain to follow the method of gradually deepening the incision of the skin through the underlying muscle planes. Dr. George L. Peabody at the New York Hospital was once engaged in the removal of a rib when Doctor Markoe, one of the early presidents of this Society, walked into the operating room. Doctor Peabody turned to him and said: "Doctor Markoe, I suppose that you fully approve of the members of the medical staff operating upon cases of empyaema?" To which his colleague replied: "Doctor Peabody, the only operation that I consider members of the medical staff capable of performing is an operation of the bowels," and with that, he turned on his heel and left the operating room.

So advancing here, retracting there, this surgical Association has done yeoman work up to the present time, to the details of which our honored guests have referred. Unfortunately its founders and early members are scarcely represented in its present roster. No Parker, Van Beuren, Sands, Weir, Markoe, Bull, McBurney or Stimson is to be found in its present membership. In only one family, that of Gerster, has the mantle of the father descended upon the son. It is to be hoped in the future that the evidence of heredity will be more marked in its membership than is the case at the present time.

As the hospitals in New York have increased in size and number so has this Society expanded, and to-day it enjoys a membership larger than at any other time in its existence. The consequent clinical material for study, research and report is enormous and alone argues well for the continued success of the Society. The question arises whether, in the future, its usefulness can be increased in any way. A fortunate step was taken in holding the annual conjoined meetings with the Philadelphia College of Surgeons which have promoted contact with surgical thought and have encouraged surgical intimacies. It is, of course, impracticable to arrange similar meetings at a greater distance from New York, but it is still perfectly possible to invite distinguished surgeons, as we have to-night, to present interesting and important surgical topics. In the past, discussion of surgical topics, especially critical discussion between individual members, has not always been generous. This important and valuable feature of the meetings should be encouraged and stimulated. I believe that by these different means the work of this Society can be made even more valuable in the future and that it will continue to exert a stimulating influence on the development of the Science of Surgery. May the good name and fair reputation of the New York Surgical Society be always maintained!

EVALUATION OF CARDIAC AND CIRCULATORY STIMULANTS FOR SURGICAL PATIENTS

By Alfred E. Phelps, M.D.
of New York, N. Y.

With the exception of hypnotics and narcotics, no class of drugs is probably more frequently administered to surgical patients than is the group comprising cardiac and circulatory stimulants. In view of the fact that practically all these stimulants and so-called stimulants have been the subject of painstaking experimentation by competent investigators, we possess at the present time a fairly accurate knowledge of the action of these drugs upon the circulatory system.

It is the purpose of this paper to assemble the results of these researches and to present the relative values of the drugs commonly employed as cardiac and circulatory stimulants in surgical shock.

Epinephrine.—Ether anæsthesia distinctly diminishes the response to minute amounts of epinephrine, and hæmorrhage also acts to lessen this response to a degree proportional to the lowering of the blood pressure. Three to four times the amount of epinephrine sufficient to produce a blood-pressure rise of ten to fifteen millimetres of mercury under normal conditions may be without effect in the exsanguinated; but the response to a large dose is uninfluenced either by ether or by hæmorrhage.[1]

Experimentally, the administration of epinephrine both intravenously and subcutaneously increases the cardiac output of normal dogs 10 to 59 per cent. However, the duration of the action is brief (less than seven minutes) and, furthermore, the cardiac output in many instances shows a tendency to return to a point below the original output, once the brief effect of the drug has disappeared. In view of these facts, it would seem that epinephrine, if used at all in the treatment of circulatory failure, should be employed cautiously and only as a temporary measure to uphold the patient's circulation until more valuable procedures, such as blood transfusion, can be employed.[2]

It has been found experimentally that the undesirable after-depressing effects of epinephrine on the blood pressure can be counteracted by small doses of barium chloride which strengthen the heart's action and sustain high blood pressure for some time.[3]

Caffeine.—It has been recently demonstrated by experiments on dogs, in which the response to stimulants is similar to that in man, that caffeine sodio-benzoate in therapeutic doses has no beneficial action on the cardiac output. In fact, the cardiac output per minute is actually diminished, and the greater the dose the greater is the reduction of the output.[4]

Camphor.—Camphor-in-oil, the commonly used circulatory stimulant in surgical shock, depresses the isolated heart both of the frog and of the rabbit.

It acts directly on the cardiac muscle and also dilates the coronary vessels. To anæsthetized animals camphor does not, however administered, cause a rise of blood pressure unless the dose is sufficient to cause convulsions. After removal of the cerebral hemispheres, no rise of blood pressure takes place even with doses up to one gram per kilogram.[5] Bodo finds that camphor dilates the heart,[6] Winterberg states that camphor is a vasodilator.[7] Its action in this respect has been corroborated by others. Heathcote from his experiments concludes: "That there is no convincing pharmacological evidence that camphor possesses any value whatever as a cardiac or circulatory stimulant. Its values, if any, for this purpose in man should be established or disproved by more exact clinical observation." [8]

Ephedrine.—Ephedrine, the active principle of the Chinese drug, ma huang, is not infrequently employed as a substitute for epinephrine. Its use is based on the fact that the substances are closely related, chemically and physiologically. The principal effect of ephedrine on the heart is that of stimulation of the accelerator mechanism, exerted simultaneously on the ganglia and nerve endings. Large doses depress the heart muscle and cause a fall in blood pressure. Constriction of the blood vessels supplied with vasoconstrictor nerves also occurs and in man this seems to be the most prominent action.[9]

With reference to its action as a circulatory stimulant, Chen and Schmidt state: "Ephedrine has been rather a disappointment. If ephedrine is given with epinephrine, ephedrine may prolong the effect of the stronger stimulant. The tendency of cardiac depression can be minimized by improving the coronary circulation by means of epinephrine and saline infusion or transfusion of blood before ephedrine is given. Ephedrine should not be injected intravenously in cases of profound shock if epinephrine fails to elicit a response, for it can do no good and may do harm. Ephedrine is certainly not to be regarded as a specific for shock. Its actual usefulness remains to be determined clinically." [9]

A comparative study of the effects on dogs of the dosage, the consistency and the duration of action of epinephrine and ephedrine reveals the following: Intravenously, epinephrine increases the circulatory minute volume more consistently than ephedrine, but it reduces the duration of action two-thirds. Subcutaneously, epinephrine and ephedrine have the same effect on the consistency and duration of action of the cardiac output. Epinephrine usually increases the pulse rate of normal dogs, whereas ephedrine produces the opposite effect. In these experiments epinephrine was used in doses that correspond to large therapeutic doses for adults, whereas the amount of ephedrine used was equivalent to an average dose for an adult patient. Because ephedrine is less variable in its action, and because after epinephrine a greater secondary depression frequently follows the initial increase in cardiac output, it would appear that ephedrine is the better drug in the treatment of circulatory collapse.[10] Ephedrine has been used recently in experimental shock by Smith who comments, "The blood rose to 90 mm.

mercury during the injection only to fall to shock levels within fifteen minutes."[11]

Pituitrin.—Pituitrin is a drug not infrequently resorted to for patients in shock. It has a definite vasoconstrictor effect on the vessels in general, but it dilates the heart to a very high degree immediately after its administration. This action, however, is transitory.[12] With reference to its use in shock, early injection of pituitary extract in physiological saline or in glucose solution often elevates the blood pressure to a normal level, but the effect never lasts more than one hour, often less, and its administration during the secondary fall of blood pressure is of no permanent value. The intravenous injection of 6 per cent. gum arabic solution in physiological saline alone, or with pituitary extract, tails to produce more than temporary results.[13]

Strychnine.—For many years strychnine has been used by clinicians on the assumption that it has a tonic effect on the human heart. Bodo found no such action in heart-lung preparations of the dog.[14]

Alpha Lobelin.—Alpha lobelin is occasionally used as a cardiac as well as a respiratory stimulant in moribund patients. Experiments show that this drug raises the blood pressure markedly, but that its effect when administered to animals moderately depressed persists for only about five minutes, while in deeply depressed animals the blood pressure is actually lowered by doses which, in less degrees of depression, will raise the blood pressure.[15] In addition, experimentally this drug commonly induces a 2:1 heart-block after either large or small doses, and this action persists for some forty-five minutes after intravenous injection.[16]

Glucose-Insulin.—The glucose-insulin treatment of shock first advocated by Fischer has been shown by Padgett and Orr[17] to be no more beneficial than treatment with a hypertonic solution of glucose or sodium chloride. With reference to this form of treatment Andrews and Reuterskiold[18] go still further and say: "That the use of insulin and glucose in patients who are suffering from post-operative conditions and are, therefore, dehydrated is a highly dangerous and useless procedure. In toxic conditions fluids are fixed by colloids and are not available for physiological purposes. For this reason the "free" water in the organisms is reduced even more than the total water. This fixation of "free" water is physiologically equivalent to dehydration. Since patients in this condition are starved and thirsty they need glucose and water. Insulin, on the other hand, tends to lower still further the already low blood sugar. In addition, it is known that surgical shock causes passage of fluids from the blood stream to the tissues. Insulin exaggerates this condition, thus producing a vicious circle. In other words, the more the blood is concentrated the more insulin acts and the more the blood is concentrated."

Digitalis.—Accurately controlled experiments by Bodo clearly demonstrate that digitalis increases cardiac tonus, that is, enables the heart to expel the same amount of blood as before, with a smaller heart volume, when the

rhythm, venous return and arterial resistance are unchanged.[6] Digitalis furthermore causes a general constriction of the vessels, with a consequent decrease of the total capacity of the vascular system, thereby increasing venous return—an effect urgently demanded in surgical shock.

Pardee [19] has shown that to produce a prompt and marked effect with digitalis large doses of the intravenous preparations, such as digitan solution, digifolin or digilin, must be given. An adequate dose for this purpose consists of one minim of the solution per pound of the patient's weight, that is, eight ampoules for a patient weighing one hundred and twenty pounds, ten for one weighing one hundred and fifty pounds, and so on. This is one half the therapeutic dose. He directs that it be given slowly over a period of two to three minutes, so that it becomes well mixed with the patient's blood and therefore does not arrive in the heart at one time, and states that while the intravenous administration of this dose of the digitalis preparations does not produce instant effect, it does produce some effect within fifteen minutes, and reaches its maximum effect in from one to two hours after administration.

SUMMARY

1. Epinephrine increases the cardiac output for a brief period (less than seven minutes) with a tendency in many instances to return to a point below the original output.

2. Caffeine actually diminishes the cardiac output.

3. Camphor-in-oil depresses the cardiac musculature and dilates the coronary vessels.

4. Ephedrine stimulates the accelerator mechanism—large doses depress the heart muscle and cause a fall in blood pressure.

5. Pituitrin constricts the vessels in general but dilates the heart to a very high degree immediately after its administration.

6. Strychnine has no tonic effect on the heart.

7. The use of insulin in shock is harmful.

8. Digitalis, in adequate dosage, is a cardiac tonic and a general vasoconstrictor, the action of which is dependable, pronounced and sustained.

BIBLIOGRAPHY

[1] Peyton, R., and Wilson, G. W.: The Influence of Ether Anæsthesia, of Hæmorrhage and of Plethora from Transfusion on the Pressor Effect of Minute Quantities of Epinephrine. Jour. Exper. Med., vol. xxix, pp. 173–186.

[2] Pilcher, C., Wilson, C. P., Harrison, T. R.: The Action of Drugs on Cardiac Output. Am. Heart Jour., vol. ii, pp. 618–629, August, 1927.

[3] Burket, I. R.: Influence of Adrenaline Modified by Salts on the Blood Pressure in the Cat. Amer. Jour. Physiol., vol. xxx, pp. 382–387, 1912.

[4] *Ibid.* 2.

[5] Heathcote, R. St. A.: The Action of Camphor, Menthol and Thymol on the Circulation. Jour. Pharmacol. and Exper. Therap., vol. xxi, pp. 177–190, 1923.

[6] Bodo, R.: The Effect of "Heart Tonics" and Other Drugs upon the Heart Tone and Coronary Circulation. Jour. Physiol., vol. lxiv, pp. 365–368, 1928.

[7] Winterberg, H.: Experimentelle Untersuchungen Uber die Wirkung des Camphers auf das Herz und die Gefässe von Saygethieren. Arch. f. d. ges. Physiol., vol. lxxxiv, pp. 455–508, 1903.

[8] *Ibid.* 5.

[9] Chen, K. K., and Schmidt, C. F.: The Action and Clinical Use of Ephedrine. J. A. M. A., vol. lxxxvii, pp. 836–841, September, 1926.

[10] *Ibid.* 2.

[11] Smith, M. J.: Studies in Experimental Shock with Special Reference to Its Treatment. Jour. Pharmacol. and Exper. Therap., vol. xxxii, pp. 465–507, 1928.

[12] Oliver, G., and Schäffer, E. A.: On the Physiological Action of Extracts of Pituitary Body and Certain Glandular Organs. Jour. Physiol., vol. xviii, pp. 276–279, 1895–1896.

[13] *Ibid.* 11.

[14] *Ibid.* 6.

[15] King, M. J., Hosmer, H. R., Dresbach, M.: Reactions of Alpha Lobelin. Jour. Pharmacol. and Exper. Therap., vol. xxxii, pp. 241–269, 1928.

[16] Whitehead, R. W., and Elliott, D. C.: Electrocardiographic Studies of the Acrion of Alpha Lobelin and Epinephrine on the Mammalian Heart. Jour. Pharmarcol. and Exper. Therap., vol. xxxi, pp. 145–176, 1927.

[17] Padgett, M. D., and Orr, T. G.: The Insulin-Glucose Treatment of Traumatic Shock. Surg., Gynec. and Obst., vol. xlvi, pp. 783–788, 1928.

[18] Andrews, E., and Reuterskiold, K.: Dangers in the Post-Operative Use of Insulin, Surg., Gynec. and Obst., vol. xlvii, pp. 665–668, 1928.

[19] Pardee, H. E. B.: Clinical Observations on the Use of Intravenous Digitalis Preparations. J.A.M.A., vol. xci, pp. 147–150, July 21, 1928.

TREATMENT OF PITUITARY TUMORS: THE RÔLE OF THE RÖNTGEN-RAY AND OF SURGERY THEREIN

By Edward Bancroft Towne, M.D.
of San Francisco, Calif.

Few neurosurgeons believe in the efficacy of the Röntgen-ray in the treatment of adenomas of the pituitary gland. Some have given it a brief trial before operation, and many use it after operation. In 1926 I [1] reported two cases of pituitary tumor in which the visual fields and visual acuity had been restored to approximately normal for periods of three and two years respectively by Röntgen-ray treatment. These cases and a review of the literature led to the following deductions. 1. That Cushing's [2] statistics showed that 20 per cent. of pituitary adenomas were cystic, and that about 20 per cent. of his patients conserved useful vision for more than five years after operation. The remaining 80 per cent. either did not regain useful vision, or had recurrences after a period of about two years. These figures suggested that the results of surgery were lasting only when a cystic tumor was encountered. 2. My cases and others in the literature showed excellent results for periods of from two to thirteen years after Röntgen-ray treatment. It must be assumed that these were solid tumors, as cysts would not respond to the Röntgen-ray, and therefore there was reason to believe that four out of five pituitary adenomas could be treated more safely and with more lasting results by Röntgen-ray than by surgery. The subsequent history of the two patients who were the basis of the previous report, and the records of three others who have been under observation for more than two and a half years, have been studied to determine their bearing on the conclusions previously drawn.

CASE REPORTS

Case I.—*Restoration of normal visual acuity and fields for five years by Röntgen-ray treatment. Recurrence, failure of Röntgen-ray, temporary improvement following operation, and death seventeen months after recurrence.*

The detailed record is given under Case I of the previous report.[1] L. L., a woman aged forty-five years, seen in February, 1922, complained of failing vision for two years. Examination showed V. O. D. 15/70, V. O. S. fingers at one metre, incomplete bitemporal defects in the visual fields, with loss of central vision on the left and a relative central scotoma on the right. There was paresis of the left sixth nerve and of the right third nerve. Röntgenograms showed destruction of the floor and dorsum of the sella. Under Röntgen-ray treatment the ocular palsies disappeared, and visual acuity and fields returned gradually to normal. Figure 1 shows the record of December 13, 1926, nearly five years after treatment was started. Recurrence was noted early in February, 1927, and a beginning bitemporal loss was charted on February 24. She was given Röntgen-

[1] Towne, E. B.: Röntgen Ray Treatment of Pituitary Tumors, Arch. Neurol. & Psychiat., vol. xv, p. 92, January, 1926.

[2] Cushing, Harvey: Les syndromes hypophysaires au point de vue chirurgical, Rev. Neurol., vol. xxxviii, p. 779, June, 1922.

ray treatments in March, April and May. Visual acuity and fields failed rapidly. There was a complete bitemporal hæmianopsia April 5, with V. O. D. 20/50, V. O. S. 20/70. June 6, the field of the left eye had disappeared (Fig. 2). June 13, 1927, by trans-sphenoidal approach, a small cyst containing about three or four cubic centimetres of chocolate colored fluid was evacuated, and fragments of solid tumor were curetted out. Improvement was rapid, so that when she left the hospital, fifteen days after operation, both nasal fields were normal, there was some restoration of temporal fields on both sides, and V. O. D. was 15/40, V. O. S. 15/70. The eyes continued to improve for three months after operation (Fig. 3), and then slowly failed. In January, 1928, the condition

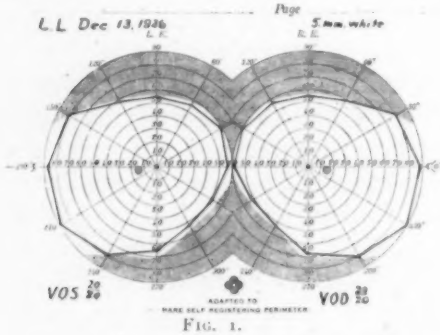

FIG. 1.

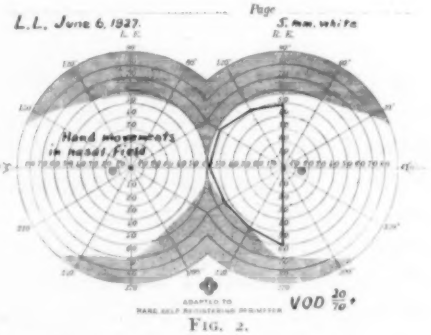

FIG. 2.

FIG. 1.—Case I. Visual fields five years after first Röntgen-ray treatments.
FIG. 2.—Case I. Fields after failure of second Röntgen-ray treatments, and before operation.

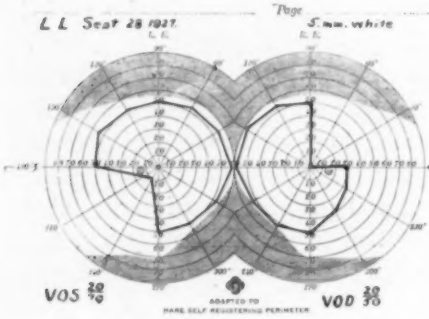

FIG. 3.

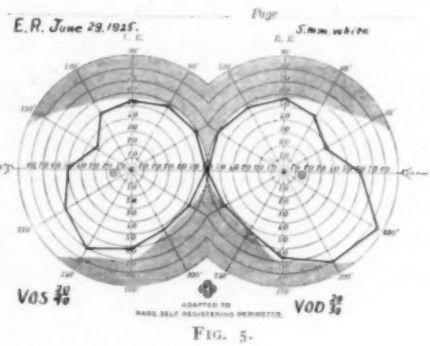

FIG. 5.

FIG. 3.—Case I. Three months after operation.
FIG. 5.—Case II. Visual fields two years after first Röntgen-ray treatments.

was again as in Fig. 2. The patient died July 7, 1928. Autopsy showed that the huge tumor (Fig. 4) was riddled with small cysts, but that at least four-fifths of the bulk was solid.

The Röntgen-ray gave an extraordinarily good result in this case. After a five-year cure, the recurrence was apparently due to the development of numerous small cysts in the tumor. There could, therefore, be no response to further Röntgen-ray, and surgical evacuation of the presenting small cyst resulted in only temporary improvement.

CASE II.—*Restoration of normal visual acuity and fields by Röntgen-ray treatment. Recurrence after two years, eight months; failure of Röntgen-ray. Prompt improvement after evacuation of cyst, lasting to date, three years after operation.*

The complete record is given under Case II of the previous report.[1] E. R., a man aged forty-two years, was seen in May, 1923, complaining of loss of vision for two

months. Examination showed absence of the left temporal field, with a relative central scotoma, V. O. D. 15/20, V. O. S. 15/70, and an enlarged sella. He received twelve series of Röntgen-ray treatments between May, 1923, and June, 1924. After three months V. O. S. was 20/40 and the left temporal field had widened to 50°. In June, 1925, V. O. D. was 20/30, V. O. S. 20/40, and there was a small defect in each upper temporal field (Fig. 5). In spite of instructions to report once a month for perimetric examination, he disappeared until February 11, 1926, when he stated that vision had been failing for six weeks. Examination showed V. O. D. 20/100, V. O. S. 20/70, and extensive defects in both temporal fields. Three series of Röntgen-ray treatments at monthly intervals resulted in further loss. April 28, the temporal fields were entirely gone, and V. O. D. was 8/200, V. O. S. 18/200, due to central scotomas (Fig. 6). May 4, 1926, a trans-

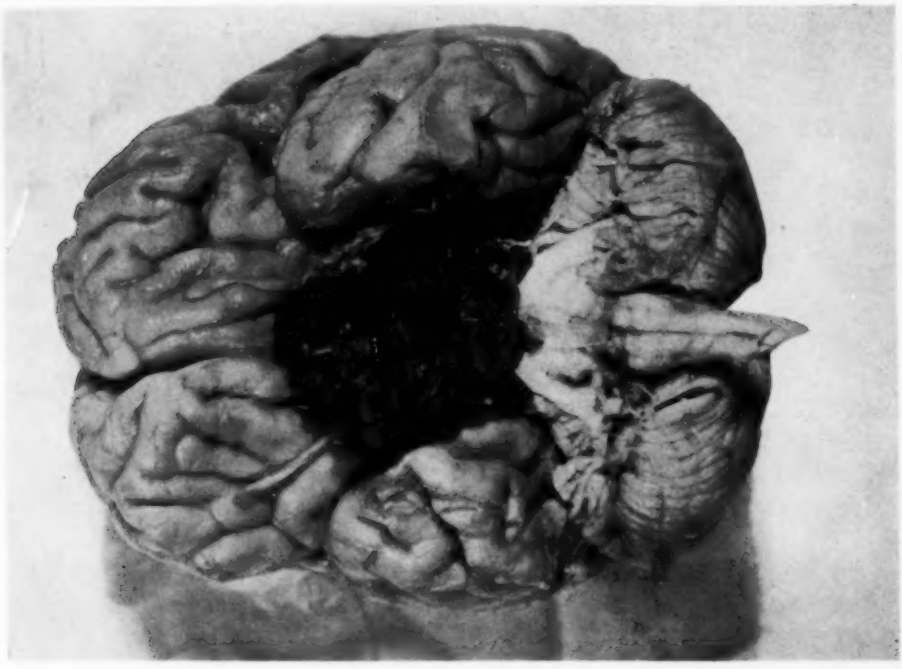

FIG. 4.—Case I. The tumor.

sphenoidal operation was done. The exposed dura looked blue. A needle was introduced and nine cubic centimeters of thin, brownish fluid were aspirated. The dura was opened, more fluid was evacuated, and a few fragments of tumor were curetted out. On the next day he could read newspaper print with the right eye. Fifteen days after operation, V. O. D. was 20/30, V. O. S. 20/70, and the visual fields were as shown in Fig. 7. Frequent reëxaminations up to the present time (June, 1929), have shown no important change. There has been no further treatment of any kind. He works steadily at his trade of watchmaker.

This case confirms in every detail the hypothesis outlined above. The adenoma was apparently solid at first, and the favorable response to Röntgen-ray lasted for nearly three years. Then the tumor became cystic, and did not respond to further Röntgen-ray treatment. Surgical evacuation of the cyst gave an excellent and apparently lasting result. It is possible that the second series of Röntgen-ray was persisted in too long, and that wider visual fields

might have been saved if the operation had been done a month or two earlier. However, useful vision has been retained for three years since operation.

Case III.—(I am indebted to Dr. Emile F. Holman, of San Francisco, for permission to report this case.) *Bitemporal hæmianopsia not improved by Röntgen-ray treatment; condition stationary three and one-third years later; operation refused.*

O. B. E., a man aged thirty-two years, was seen in consultation with Dr. Emile F. Holman, February 25, 1926. He had been referred to Doctor Holman by Dr. K. H. Martzloff, of Portland, Oregon. Loss of the temporal field of the left eye was noted by the patient in April, 1925. Examination at that time showed a positive Wassermann

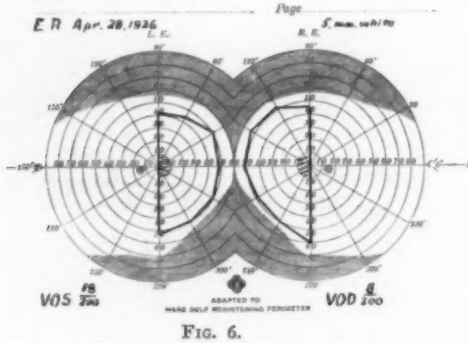

Fig. 6.

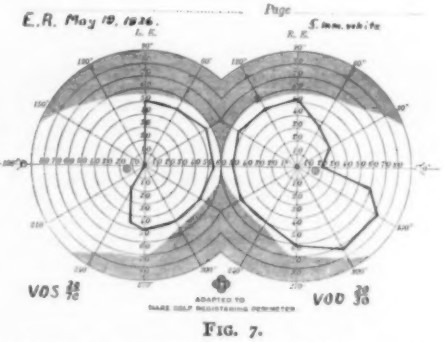

Fig. 7.

Fig. 6.—Case II. Fields after failure of second Röntgen-ray treatments, and before operation.
Fig. 7.—Case II. Two weeks after operation.

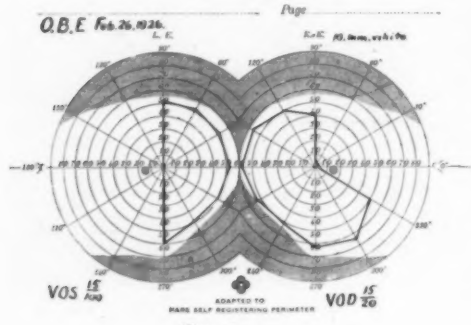

Fig. 8.

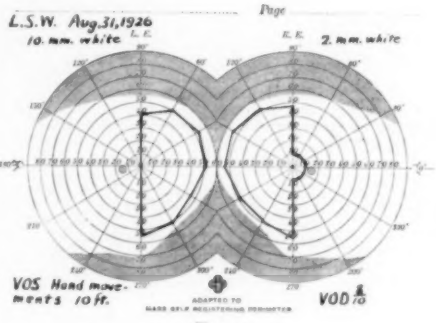

Fig. 9.

Fig. 8.—Case III. Visual fields before Röntgen-ray treatments.
Fig. 9.—Case V. Visual fields before Röntgen-ray treatments.

reaction in the spinal fluid, an enlarged sella turcica, bitemporal hæmianopsia for colors, a large scotoma in the left temporal field involving the central area, V. O. D. 15/20, V. O. S. 15/200, blurring of the disc margins and tortuous retinal veins (Dr. A. B. Dykman). Under vigorous antiluetic treatment the visual fields shrank, and in January, 1926, Doctor Dykman reported a complete bitemporal hæmianopsia except for an island in the lower right temporal field. Doctor Holman's notes in February, 1926, added the fact that there had been diplopia for six months. The röntgenogram showed an enlarged sella, V. O. D. was 15/20, V. O. S. 15/100, and there was a nearly complete loss of temporal fields (Fig. 8). I advised Röntgen-ray treatment, warning the patient that operation would be indicated if there were further loss, or no improvement after about five months. He was treated once a month for twelve months. There was no change, except that headache and diplopia disappeared, and the lower temporal field of the right eye was lost. The patient was seen by Doctor Holman in June, 1927. Examination showed that the bitemporal loss remained complete, and that V. O. D. was 20/20,

V. O. S. 15/100. Operation was advised and refused. Doctor Martzloff reported in June, 1929, that the patient had not consulted him since 1927, but that he was carrying on his work, and that his vision was sufficient to allow him to drive an automobile.

This case is complicated by cerebrospinal syphilis, but the ballooned sella is positive proof of an adenoma of the anterior lobe. It seems probable that the tumor is partly cystic, and that further growth of the solid portion has been checked by the treatment. The patient has undoubtedly run a great risk of losing useful vision by refusing operation.

CASE IV.—*Blindness for three months. Slight response to Röntgen-ray; no response to surgery.*

W. L. B., a man aged fifty years, was seen April 30, 1926. Ten years previously he noticed loss of both temporal fields, but he retained useful vision until eighteen months before entry, when he had to stop driving an automobile. He had been totally blind for three months. Examination showed an enlarged sella with destruction of the dorsum, V. O. D. and V. O. S., hand movements in nasal fields, and optic atrophy. He received eight series of Röntgen-ray treatments at monthly intervals. There was slight improvement in the vision of the left eye, so that after the fourth series he could count fingers, and avoid the furniture in walking about a strange room, but it lasted for only a few weeks. Surgical treatment was advised, but refused until June, 1927, when a transsphenoidal operation was done. No cyst was found, and vision did not improve. The patient remains blind at the present time, two years after operation.

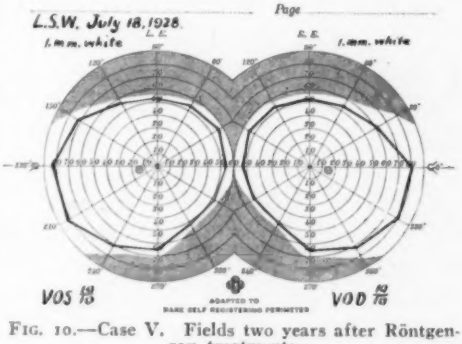

FIG. 10.—Case V. Fields two years after Röntgen-ray treatments.

This case is unimportant and is included only to record all experiences. The optic atrophy was too advanced to allow a result from any procedure, and the operation was undertaken only because of the slight improvement following the first few Röntgen-ray treatments.

CASE V.—*Bitemporal hæmianopsia with loss of central vision in left eye, cured by Röntgen-ray. Normal visual acuity and fields two years, ten months later.*

L. S. W., a woman aged sixty-four years, was referred by Dr. Otto Barkan, of San Francisco, September 1, 1926, with the diagnosis of pituitary tumor. She had noticed loss in both temporal fields and failing vision in the left eye for six months. The Röntgenogram showed a deep sella with destruction of the dorsum and of the left anterior clinoid process. Perimetric examination by Doctor Barkan showed a bitemporal hæmianopsia, but it should be noted that he used different-sized test objects for the two eyes, and that the patient could see large objects in the right temporal field (Fig. 9). V. O. D. was 8/10, V. O. S., hand movements at ten feet. Five series of Röntgen-ray treatments were given at intervals of a month. The patient said that her vision was better immediately after the fourth series, and examination before the fifth series showed a beginning return in both temporal fields, but no improvement in visual acuity of the left eye. She did not report to Doctor Barkan again until May 3, 1927, three months after the last treatment, when he found V. O. D. 8/10, V. O. S. 6/10, and nearly normal fields to 1 mm. disc. In July, 1928, the fields were complete and vision was 10/10 in each eye (Fig. 10). At the present time (June, 1929), the visual acuity and fields remain normal.

In this case treatment was stopped after the fifth series, when the first slight improvement appeared. This was done because of our experience in Case II, in which, although the visual fields widened after the third series, nine more were given in the next ten months, and it seemed possible that overtreatment might have caused the cystic degeneration in the tumor.

Technic.—Most of the Röntgen-ray treatments in these cases were given by Dr. W. E. Chamberlain and Dr. R. R. Newell at Stanford University Hospital. As the technic was gradually developed certain changes were made, but the methods used in Case V are representative of what they now advise and practise. Doctor Newell has kindly furnished the following summary of the treatment in this case: "Mrs. W's program of X-ray treatment was 200 R filtered X-ray (lambda effective equals 1.17 Angstroms) to each of five areas, each temple, forehead, vertex and occiput, given every month. These were divided among three days on each monthly series. The areas were 9 x 9 cm., and the tube distance 31 cm."

Discussion.—The only reason for presenting such a small series of consecutive cases would be that the results, observed over a sufficiently long period, show clearly that the treatment employed is preferable to that generally used. Does a review of these five cases indicate that the initial use of Röntgen-ray gave better results than might have been expected from the initial use of surgery? Knowing that most, if not all, solid tumors show recurrences within two years, it seems highly improbable that normal fields and vision could have been restored for five years in Case I by any operative method. The patient's poor condition, and the size of the tumor as revealed by areas of calcification, caused me to refuse to undertake surgery and to try Röntgen-ray treatment, with little hope of a favorable result. In Case II the result of Röntgen-ray therapy was excellent for nearly three years, and might have lasted indefinitely if the treatments had not been kept up too long, if it is assumed that overtreatment caused the cystic changes in the tumor. Perhaps primary operation would have also given, at a greater risk, a cure for nearly three years, but there is no reason to believe that the cystic degeneration, which made the case so favorable for surgery, would have taken place without Röntgen-ray treatment. If there is a cystic tumor, as suspected in Case III, primary operation would have been preferable. As soon as it was seen that conditions were remaining stationary under Röntgen-ray treatment, operation was strongly urged, and refused by the patient. The subsequent course shows that the chance of saving useful vision was not compromised by the Röntgen-ray treatment. Case IV proves nothing, as there was no important result from either method of treatment because of advanced optic atrophy. In Case V, the perfect result to date, two and three-quarters years after treatment was started, is better than one would expect from surgery. It appears, therefore, that of the five cases, in one the condition was too advanced to be helped by any therapy, in another the patient refused surgery when Röntgen-ray failed, and in three the results of Röntgen-ray treatment were better and safer than could have been expected from surgical treatment. Of these three, one

eventually required surgery, which did no good, and another developed the cystic changes in which surgery gives brilliant results.

Numerous scattered reports of pituitary adenomas favorably influenced by the Röntgen-ray are appearing in the literature. Physicians are beginning to try this method of treatment. It will be unfortunate if the cases are not selected carefully. Only adenomas of the anterior lobe, which enlarge and destroy the sella, are amenable to Röntgen-ray therapy. Other tumors in the region of the chiasm may give the characteristic picture in the visual fields, but not the changes in the sella, and none of these will respond to the Röntgen-ray. There should be thorough coöperation between the ophthalmologist, Röntgenologist and neurosurgeon in the treatment of pituitary adenomas. A satisfactory method is to insist that the patient report for perimetric examination before each treatment. Thus the situation from month to month is known to all concerned, and the question whether to continue the Röntgen-ray treatment or to resort to surgery is open to consideration at these intervals. A result is not to be expected from one or two series of treatments. In Case I there is no accurate information beyond the patient's statement that she could read large type after four months, but in Case II the perimetric examinations showed improvement after three months, and in Case V after five months. It would appear safe to continue with Röntgen-ray, provided there is no loss, for at least six months before resorting to surgery. The present rather general practise of operating on pituitary adenomas and following immediately with Röntgen-ray treatment for many months is most undesirable. The two methods of therapy must be used separately, if we are to know what each can accomplish. It is not to the disadvantage of the patient to use them one at a time, for, if one fails, the other can be resorted to immediately.

The most important question which remains unsettled is whether the 20 per cent. of patients in Cushing's statistics who retained useful vision for more than five years after operation, represent the same group as the 20 per cent. in whom cystic tumors were found at the original operation. This can be settled only by the records of a clinic which has operated on a large series of cases and carefully followed the late results. If this be true, it would clinch the argument, and show that only the cystic tumors, which will not respond to Röntgen-ray, should be operated on.

CONCLUSIONS

1. Eighty per cent. of pituitary adenomas are solid, and 20 per cent. are cystic.

2. Twenty per cent. of patients retain useful vision for more than five years after operation; 80 per cent. show no improvement or, after more or less marked improvement, have recurrences after about two years.

3. Operative treatment of pituitary adenomas has a mortality ranging from 7 per cent. upward; Röntgen-ray treatment has no mortality.

4. Cases are reported which illustrate long-standing favorable results

from Röntgen-ray treatment, and show that if the result is not good, a cystic tumor, favorable for surgery, may be diagnosed.

5. The present custom of following surgery immediately with Röntgen-ray treatment confuses the issue. The two methods may be used separately without jeopardizing the patient's chance for a cure.

6. It is proposed that all pituitary adenomas be treated by Röntgen-ray under the observation of the opthalmologist and the neurosurgeon, that the treatment be stopped as soon as improvement begins, and that surgery be undertaken short of six months only when visual acuity and fields recede under Röntgen-ray treatment.

GIANT CELL TUMOR OF THE SPINE*

By José V. Santos, M.D.

of Chicago, Ill.

From the Surgical Clinic of the University of Chicago

The following report of giant cell tumor of the spine merits recording for three reasons. First, it is relatively uncommon in the spine; second, its diagnosis is not easily made, and, finally there is a marked destruction with collapse of the affected vertebra.

D. G., male, white, age twenty-seven, married, was brought to the University of Chicago Clinic May 16, 1928, on account of pain in the left groin and lower part of the back which had existed for nearly five months. There was no injury preceding the development of the trouble. It was a dull ache at that time that did not interfere with his sleep at night or his activities during the day. For the last few days, he began to complain of pain in the left hip and back so severe that he could not sleep. He walked the floor most of the night; during the day, however, the pain did not bother him. Nearly two months later, while getting into a wheel chair, he was struck with an acute pain and spasm of the lumbar muscles on the right side. The pain caused him to perspire freely; he claimed that it felt as if something had become loose in his back, and sent burning sensations down both legs and scrotum. Abdominal rigidity soon developed and for the last twenty-four hours he had been unable to urinate and defecate. In the evening, he began to complain of burning sensation in the scrotum and buttocks with pain and tenderness on pressure over the first and second lumbar vertebræ. His temperature rose to 100.2 F. Total leucocyte count was 17,000 with 84 per cent. polymorphonuclears. On examination, the patient was feverish. He complained of incontinence, inability to move the bowels, numbness of the right half of the abdomen above the pubis and weakness of both legs. Voluntarily the abdomen and back muscles were held in a rigid state. There was slight stiffness and tenderness of the spine especially over the first lumbar vertebra with spasm of the lumbar muscles. The right hip showed marked limitation in flexion, extension and adduction. Abduction was impossible. Internal and external rotations were slightly limited. The left hip had practically a normal range of motion. Both legs were weak. Active movements of the right knee were impossible; the left could not be flexed but could be extended. The patellar tendon reflex was absent on the right and weak on the left. Both knee kicks were absent. Achilles tendon reflex and abdominal reflexes were absent. Cremasteric reflex was negative on the right and weakly positive on the left. There was a slight diminished sensation to touch downward from the right groin.

Fig. 1.—Before operation. Röntgenogram taken July 6, 1928. Antero-posterior view. Note the destruction and collapse of the body of the first lumbar vertebra and the destruction of the left vertebral arch. The articular surfaces are preserved. No new bone production.

* This work has been conducted under a grant from the Douglas Smith Foundation for Medical Research of the University of Chicago.

Sensation to cotton, pinch and pressure was normal over both legs. There was an anæsthesia for touch around the penis, perineum and scrotum which reached down on the medial side of the right thigh to the extent of four fingers. On the left, this extended only to about three fingers' breadth on the upper medial aspect of the thigh. In addition to these findings there was also hypoæsthesia for touch over the buttocks for about three fingers' breadth around the anus. July 6, 1928. A röntgen-ray examination of the spine revealed a gross destruction of the body of the first lumbar vertebra with crushing and resultant anterior angulation of the spinal column. The left transverse process and the left root of the vertebral arch were also destroyed. No changes in the twelfth thoracic and second lumbar could be made out, and there was no evidence of new bone production. An exact röntgen-ray diagnosis of the character of the bone lesion in the vertebra could not be made. (Figs. 1 and 2.)

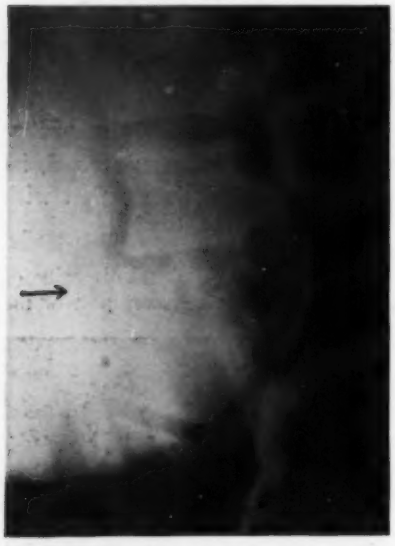

FIG. 2.—July 6, 1928. Lateral view. The site of the lesion is indicated by an arrow.

In view of the neurologic symptoms and the röntgenogram of the spine, it was decided to do a decompressive laminectomy under an indefinite diagnosis of a metastatic malignant tumor of unknown primary origin or tuberculosis of the vertebra. Inasmuch as the compression symptoms were of short duration it was felt that such an operation should be done as soon as possible. Exploratory laminectomy was performed July 4, 1928, under ethylene anæsthesia. The spines and laminæ of the twelfth dorsal, first, second and third lumbar vertebræ were removed. Immediately upon removing the spinous process and laminæ of the first lumbar vertebra a purple, dark mass came into view on the dorsal aspect of the dura mater. Under the spinous processes, this extended as low as the second lumbar and as high as the twelfth dorsal, beyond which limits normal dura mater was seen. The mass was easily separated from the dura to which it was not attached; and extended into the body of the vertebra, which was eroded and destroyed, and invaded the muscular tissue. The lateral boundaries were found and freed, but it was impossible to remove completely the tumor lying in front of the spinal cord. It was reported by the pathologist to be benign giant cell tumor. (Fig. 3.) The usual closure of the wound was made. Convalescence was uneventful, and the patient was dismissed on February 16, 1929. As a precautionary measure, a course of six deep X-ray was carried out. There was

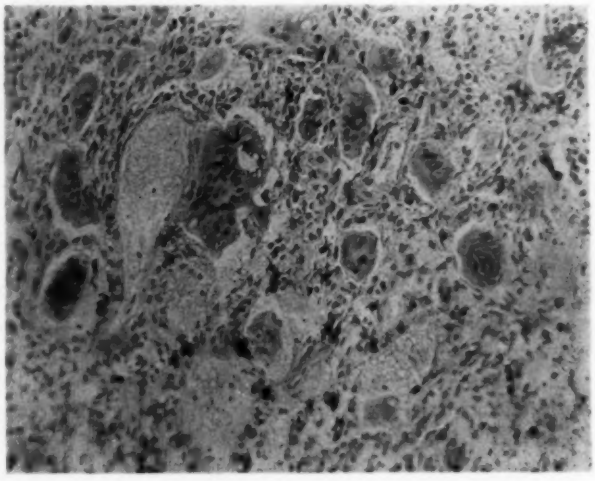

FIG. 3.—Histological appearance of the tissue removed at operation showing numerous giant cells of the epulis type, and a markedly hæmorrhagicstroma.

marked impovement in movement and sensation although the urinary retention still persisted. Two months prior to dismissal, a swelling appeared on the back to the right of the first and second lumbar vertebræ. This was quite soft in consistency and corresponded to the area of slightly increased fibrillary densities as seen in the subsequent röntgenograms. (Figs. 4 and 5.) At the time of discharge, he was able to walk fairly well and for considerable distances with the aid of spinal brace and cane. There was a slight sacral anæsthesia present. Although he was able to void spontaneously, there was still sufficient urinary retention to necessitate routine catheterization three times a day. Röntgenograms of the spine at this time showed disappearance of the fine fibrillary density (ossification) about the body of the first lumbar vertebra and the left transverse process of the second lumbar vertebra. With this there was slight anterior displacement of the lumbar vertebræ causing an increase in lumbar lordosis and dorsal kyphosis. A slight decrease in the space between the twelfth thoracic and second lumbar vertebræ was also noted as if increase compression of the body of the first lumbar vertebra had taken place. (Figs. 6 and 7.) July 28, 1929 (one year after the laminectomy) he returned for re-examination and was found to be free from the sacral anæsthesia although the urinary retention was still persistent. There was a marked limitation of motion of the lumbar spine. The place of the soft swelling to the right of the first and second lumbar vertebræ was now occupied by a slightly smaller mass which was of bony consistency. On röntgen-ray examination, this mass showed marked ossification which suggests cessation and healing of the process. (Figs. 8 and 9.)

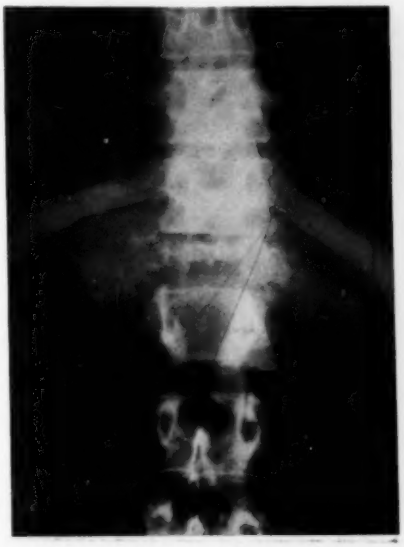

FIG. 4.—After operation. Röntgenogram taken seven weeks after the laminectomy antero-posterior view. Note the fine, fibrillary lines of increased density (ossification) about the body of the first lumbar vertebra.

FIG. 5.—Lateral view. Note angulation at the dorso-lumbar region, and the displacement of the vertebræ.

In reporting a case of giant cell tumor of the vertebra, LEWIS in 1924, reviewed briefly the histories of sixteen cases gathered from the literature. The following cases have also been found:

ROGERS (1903), 1 case. This was a male twenty-two years of age, who started to have pain in the small of the back in 1899. Three years later, a tumor was discovered occupying and involving the spinal lumbar region. Biopsy of this mass was made and reported by Doctor Brooks as typical giant cell sarcoma. Signs of paralysis appeared and rapidly increased. Injection of pure erysipelas toxins was begun but had to be discontinued three months later as the reaction became violent. There was a complete motor and sensory paralysis below the waist and incontinence of urine and feces. He was in a pitiable and hopeless condition. Two months later, however, improvement

began to occur, and eight months after the biopsy, all the distressing symptoms had disappeared. The tumor in the back was still present and had slightly decreased in size, and the patient had slight night frequency of 5-6 urinations. He was able to sit up and walk about.

FIG. 6.—Röntgenogram taken seven months after the operation. Antero-posterior view. Note the disappearance of the fine lines of ossification. The left transverse process of the second lumbar vertebra is nearly gone.

CAMURATI (1927), 1 case. This was a male twenty-five years old who was seen in 1913 complaining of pain in the neck subsequent to sudden turning of the head to one side. On examination, there was found marked spasm of the muscles of the neck and pronounced tenderness at the second cervical spine. Sensibility and reflexes were normal. Röntgen-ray examination of the cervical spine disclosed fracture at the base of the notch of the epistropheus with anterior luxation of the Atlas. He wore a celluloid collar and for a year afterwards was apparently well. On March 7, 1915, he began to complain of pain in the neck, difficult deglutition, anarthria and sphincter disturbance. On examination, the following were found: spastic tetraplegia, anæsthesia over the superior thoracic region and anterior aspect of the neck, patellar tendon reflexes were exaggerated; cremastric and abdominal reflexes, absent; ankle clonus, Babinski and Oppenheim were exaggerated on both sides. Röntgen-ray examination of the cervical spine at this time showed marked atrophy of the first cervical vertebra with zone of rarefaction in irregular form. On March 31, 1915, the patient died from bulbar paralysis. Necropsy revealed giant cell tumor involving the first cervical vertebra.

ADSON (1928), reported two cases published under the title of "Osteitis Fibrosa Cystica of the Spine." The first case was a boy aged fourteen years, who was seen with paralysis of the lower extremities. Six months before admission, he started to have pain in the right side of the lower dorsal spine, followed 3-5 months later by difficulty in urinating, incontinence of the rectal sphincter, numbness over the legs and lower abdomen, complete paralysis of the lower extremities and loss of sensation below the umbilicus. The reflexes below the tenth dorsal segment were exaggerated, more so on the right than on the left. Röntgen-ray examination of the dorsal and lumbar spines revealed destruction of the right half of the tenth dorsal vertebra with circumscribed shadow between the tenth and eleventh ribs, suggestive of tumor. Exploratory laminectomy exposed an extradural mass which involved the laminæ and transverse processes of the ninth and tenth dorsal vertebræ (right side), and part of the tenth rib on the same side. The diagnosis of a benign foreign-body giant cell tumor with hæmorrhagic cyst formation was made. A course of deep Coolidge-tube röntgen-ray treatment was subsequently carried out. Nearly two years and nine months

FIG. 7.—Seven months after the operation. Lateral view.

later, the boy was able to work normally and the incontinence of urine and feces had totally disappeared.

The second case was a girl thirteen years old with a tumor in the back of the neck of three months' standing; there was associated pain but without paralysis. She gave a history of having twisted her neck five months before. On examination, there was a firm, rounded mass, slightly to the left of the median line opposite the second and third cervical vertebræ. Röntgenogram of the cervical spine showed a cyst-like tumor situated posteriorly apparently springing from the second and third cervical vertebræ. Laminectomy was done and a rounded mass was removed from the laminæ of the second and third cervical vertebræ. Pathological study showed a friable, clot-like brownish material which contained foreign-body giant cells as well as cystic degeneration of old hæmorrhagic material and granulation tissue. About five months later, the child was found perfectly well.

FIG. 8.—Röntgenogram taken a year after the operation. Antero-posterior view. Note the marked ossification at the left side of the first lumbar vertebra.

COTTON (1928), 1 case. This was a boy fifteen years old who had a fall on the buttocks. Two months later, he began to have pain in the lower part of the back and left hip. Then again three months later, he had a wrench of the back. On examination, the back was found stiff and painful with a kyphus over the fourth and fifth lumbar and first portion of the sacrum; a fluctuating mass the size of a grapefruit to the left of the spine of the fourth and fifth lumbar vertebræ; flexion contracture of both hips; paralysis of the anterior tibial muscle group; anæsthesia along the distribution of the external popliteal nerve and loss of the left patellar tendon reflex. Röntgen-ray examination revealed bone destruction of the left side of the body, transverse process, lamina and pedicle of the fifth lumbar and left ala of the sacrum. No bone production. The clinical diagnosis of lumbo-sacral Pott's disease with lumbar abscess was made. Exploratory operation over the mass showed a cavity containing old blood, friable granulation tissue and loose pieces of bone. Histo-pathological examination of the tissue showed a benign giant cell tumor. General constitutional treatment with four series of Röntgen-ray therapy were given. Two years after the operation, the tumor disappeared, and the patient was able to walk with a cane. A slight decrease in sensation, however, remained over the outer surface of the left leg and dorsal aspect of the left foot. Röntgen-ray examination of the spine at this time revealed new bone production at the site of the lesion.

FIG. 9.—Lateral view.

Including the case herein reported, there are in all twenty-three cases of primary giant cell tumor of the vertebra found in the literature. The röntgenograms present characteristic circumscribed area of diminished density with

fine, fibrillary lines of ossification within the tumor. A secondary collapse of the vertebral body, as in this present case, however, has not been noted before. The above case emphasizes the importance of biopsy in establishing a diagnosis and demonstrates that where there is marked destruction and collapse of the vertebra, röntgenogram alone would not be of much diagnostic value in differentiating it from metastatic malignant lesion.

There are certain striking features of this condition which merit careful scrutiny and discussion. The lesion, occurring relatively more frequently at the lumbar spine than at the other portions of the spinal column, shows greater tendency to increase rapidly and heal more readily by ossification, spontaneously or following partial removal, when located at the cervical and lumbar spines. All the cases where the lumbar and cervical vertebræ formed the site of the lesion reveal extension through the vertebræ into the surrounding musculature with the consequent formation of palpable soft mass within a year of the onset of the symptoms. Subsequently an extensive ossification of the lesion generally occurs spontaneously or following an incomplete removal. In a way, this would indicate that they differ in some respects from the giant cell tumors occurring in long bones, which as a rule do not ossify, although ossification is also often noted following fracture (pathological) through the site of the lesion. This fact and the frequent occurrence of early and extensive ossification of giant cell tumors located in the lumbar and cervical vertebræ, which are undoubtedly the most mobile portions of the spinal column, is so striking and suggestive that one is tempted to resort to stress and strain as a probable cause of the enhanced ossification.

Urinary disturbance is one of the most distressing and persistent symptoms in these cases. In four of the six cases where this symptom was noted, the disturbance finally disappeared from one to three years after the partial removal of the lesion. One case, however, had persistence of the bladder and rectal disturbances nine and one-half years following an incomplete removal of the lesion. Death, probably from an ascending urinary infection, occurred in one case. On the whole, therefore, although the urinary disturbance has a tendency to hang on it ultimately disappears; and, whatever danger there may be of a subsequent grave ascending urinary infection is but slight.

CONCLUSIONS

1. Giant cell tumor of the vertebra may lead to destruction and collapse of the affected vertebra.

2. Biopsy is the only certain method in establishing a diagnosis.

3. Twenty-three cases of primary giant cell tumor of the vertebra are found in the literature.

4. Ossification of the lesion is early and extensive when the lumbar and cervical vertebræ form the site of the tumor.

5. The associated urinary disturbance ultimately disappears in most cases, although it may persist for a long period of time.

BIBLIOGRAPHY

[1] Lewis, D.: Primary Giant Cell Tumors of the Vertebræ. Analysis of a group of cases, with report of case in which patient is well two and nine months after operation. J. A. M. A., vol. lxxxiii, p. 1224, 1924.

[2] Rogers, J.: Giant Cell Tumor of the Vertebra. ANNALS OF SURGERY, vol. xxxvii, p. 103, 1903.

[3] Camurati, M.: Tumore a Mieloplassi del Rachide Cervicale. Chir. delgi Org. di Movimento, vol. vi, p. 581, 1927.

[4] Adson, A. W.: Osteitis Fibrosa Cystica of the Spine. Surg. Gyn. Obst., vol. xlvii, p. 684, 1928.

[5] Cotton, A.: Giant Cell Tumor of the Spine. Am. J. Roentgenology and Radium Therapy, vol. xx, p. 18, 1928.

SARCOMA OF THE THYROID GLAND

By Isidore Arons, M.D.

of New York, N. Y.

FROM THE RADIUM THERAPY DEPARTMENT OF THE FLOWER HOSPITAL

Malignant disease of the thyroid gland is admittedly infrequent. Of this small group, the epithelial tumors predominate over those of mesoblastic origin. The thyroid anlage is an entodermal derivative, which shares, with the remainder of the alimentary tract and its allied organs, a rare disposition to sarcomatous development. The gross anatomic appearance, the age of incidence, and the clinical course of thyroid carcinoma and sarcoma are so similar that it is almost a clinical impossibility to differentiate preoperatively between them.

Incidence of Thyroid Sarcoma.—There is considerable disparity of opinion among authorities concerning the frequency of this disease. Kocher [15] stated that the thyroid gland is one of the chief seats of "acute" sarcoma. *Per contra,* Craver [8] says, "the occurrence of true sarcoma of the thyroid in man is doubtful." However, in nineteen of his histologically proven cases, seventeen were carcinomatous, one was round-cell sarcoma, another was small spindle-cell sarcoma. In 1902, Ehrhardt [11] was able to collect ninety-nine case reports of thyroid sarcoma together with 150 carcinomas of the same organ. This ratio does not exist in the papers of later authors. Herbst [12] reported that of 290 patients with malignant disease of the thyroid gland, seen at The Mayo Clinic between 1901-1921, nineteen had sarcoma. Simpson examined microscopically 1449 extirpated thyroids and found only fifty carcinomas and five sarcomas. Muller and Speese [20] collected the literature covering 117 cases of sarcoma of the thyroid; of these 30 per cent. were of the spindle-cell type, 23 per cent. were round-cell sarcomas and 17 per cent. were mixed-cell sarcoma. Speese and Brown [25] studied 426 lesions of the thyroid gland, among which carcinoma occurred nineteen times, and sarcoma three times. Bloodgood [4] found nine carcinomas and only one sarcoma in 148 thyroid lesions, surgically removed. Limacher [17] in Berne discovered forty-four sarcomas and thirty-eight carcinomas of the thyroid gland in 7641 autopsies. For his study of malignant disease of the thyroid gland, Louis B. Wilson,[30] in 1921, included European and American reports to total 991 malignant epithelial tumors and 195 sarcomas. The ratio of carcinoma to sarcoma is variously given as ten to one, or even four to one (Tebbutt and Woodhill).[26]

Ætiological Factors.—The greatest incidence of thyroid malignancy occurs in those particular geographic areas where endemic goitre is prevalent. This is an agreement with the general observation that malignant neoplasms have tendencies to develop in those tissues or glands which have been involved

in a preëxisting disease, in this instance—goitre. Chambers [7] believes it probable that in many instances a slow development of a primarily malignant goitre occurs, rather than the transformation of a previously benign goitre. Goitre may exist, however, for many years before sarcoma develops; twenty years in Becker's [2] case. Sarcoma and carcinoma are quite uncommon in non-goitrous thyroids, in my opinion. In Lartigau's [16] analysis of fifty-one cases of sarcoma of the thyroid, a history of preexisting goitre was obtained in thirty-five instances. Chronic irritation produced by foci of degeneration in old colloid goitres may induce parenchymatous or stroma hyperplasia, occasionally resulting in carcinoma or sarcoma respectively. Carcinomatous and sarcomatous degeneration occur in the adenomatous types of goitres. At The Mayo Clinic, Herbst [12] did not observe one single instance of malignant neoplasm in 5867 specimens of exophthalmic goitre.

Other frequently mentioned ætiologic factors are trauma and previous inflammation of the gland. Balfour has seen several cases of malignancy which developed subsequent to the injection of various irritants into large thyroids.

Both sexes are equally affected in sarcoma of the thyroid (Becker).[2] Of forty-nine case reports of thyroidal sarcoma which I have been able to cull from the literature, there were twenty-two males and twenty-seven females.[1, 2, 3, 5, 19, 20, 26, 27, 29, 30, 32] In benign goitre, the females frequently outnumbered the males in proportions of seven to one or even ten to one, but this difference in sexual incidence does not obtain for carcinomas and sarcomas of the thyroid. The reason for this disparity is not yet apparent.

Most sarcomas of the thyroid occur in the fifth and sixth decades of life. In this review, I found the average age to be fifty-three years. One unusual and striking difference of thyroid sarcomas from those sarcomas occurring in other body regions, is the uniformly late age at which the former appear.

The signs and symptoms of malignant disease of the thyroid gland.—Sarcomas and carcinomas of the thyroid are not commonly diagnosed correctly, while they are in the operable stage of the disease. The difficulty of correct diagnosis exists until the capsule of the gland is perforated by the growth. It is almost a clinical impossibility to distinguish between carcinoma and sarcoma of the thyroid. The rate of growth and approach of death are much more rapid, however, in sarcomas than in carcinomas, but this is a weak criterion for clinical differentiation.

The clinician must attempt to differentiate malignancy of the thyroid gland from benign adenomas of the thyroid with different forms of degeneration, from tuberculosis of the thyroid and from sudden hæmorrhage into a cystic cavity of the thyroid. Acute strumitis is usually generalized, whereas sarcoma is confined locally to one part of the gland, but it must not be forgotten that malignancy and infection may coexist. The occurrence of branchiogenic cysts and cysts of the cervical sinus along the anterior border of the sternomastoid muscle and the similar location of aberrant thyroid malignancies should be remembered.

The local manifestations of cancer of the thyroid usually precede any symptoms of altered thyroid function. The first notable sign is some change in the physical characteristics of the primary benign goitre, particularly when such a goitre becomes hard, bossy, nodular and irregular. Suspicion is immediately aroused by the rapid and steady increase in size of a previously quiescent goitre in a patient over forty years of age.

The presence of outlying hard palpable lymph nodes is suggestive and for diagnostic confirmation one of such nodes may be removed and examined histologically. This procedure aids in determining the treatment to be employed; if the tumor is inoperable, the histological picture of the nodal metastases determines the expectation of response to irradiation.

Enlargement of subcutaneous veins over the tumor is a late finding and is not of frequent occurrence. Fixation of the tumor to the skin is more frequent in sarcoma than in carcinoma but, at the most, is a very late and uncommon phenomenon, as is ulceration. After the capsule of the thyroid has been perforated, decreased mobility of the gland soon occurs, so that the palpating fingers detect the fixity of the thyroid growth to the trachea and larynx, which often move with the tumor.

Although the major portion of the thyroid may be involved in the sarcomatous process during the terminal period of the disease, the symptoms of hypothyroidism are never in evidence. Tremor, palpitation, loss of weight, tachycardia, increased metabolic rate, in fact the Basedowian syndrome (exclusive of exophthalmos) may accompany a small percentage of sarcomas of the thyroid. Tillaux [28] found typical symptoms of exophthalmic goitre (except tachycardia) in a case of sarcoma of this gland. After removal of the sarcoma, the toxic symptoms disappeared, but the patient died later with metastases.

The appearance of neuralgic, radiating pains has been known to precede the local appearance of the tumor, but this is not the customary sequence. The pain radiates from the neck up the side of the head to the ear (N. occipitalis major), or down into the shoulder and arm. It is usually a unilateral pain. It is due to the manifestations of deep growth and pressure upon or involvement of deep cervical nerves.

Dyspnœa is a frequent symptom and is produced by sabre-sheath stenosis of the trachea. Lateral radiographs of the neck demonstrate very clearly this antero-posterior compression of the trachea and the chondro-malacia of the tracheal rings. The sarcoma may penetrate the trachea deep enough to produce bloody expectoration. The hoarseness which sometimes occurs is caused by vocal cord paralysis (laryngoplegia) from involvement of the recurrent laryngeal nerve in the tracheo-œsophageal sulcus. In such an event, laryngoscopic examination is important because benign goitres do not frequently produce paralysis of the vocal cords. The brassy or "goose" cough which accompanies many aneurysms of the aortic arch, occasionally is a symptom of malignant disease of the thyroid.

If the growth begins on the posterior aspect of the thyroid, a dysphagia

frequently develops, which is due to direct attachment to the œsophagus rather than pressure alone. Dysphagia is an uncommon symptom of benign goitres, even in the substernal type.

Pressure of the tumor growth upon the cervical sympathetic nerves, or infiltration of the sarcoma in the region of the carotid sheath may produce paralytic miosis, loss of the pupillary reflex, unilateral facial hyperæmia and sweating, enophthalmos and narrowing of the palpebral aperture.

Fever, as high as 102.5 F., has been known to precede the appearance of the sarcoma. Fever is far more common with sarcoma than with carcinoma of the thyroid.

Classification of Sarcomas of the Thyroid.—1. Spindle-cell sarcoma, of which the fibro-sarcoma is a desmoplastic type. The most common variety of sarcoma of the thyroid gland.

2. Round-cell sarcoma, including a type that resembles the malignant lymphocytoma.

3. Mixed-cell sarcoma, of which the so-called giant-cell sarcoma is a sub-group.

4. Carcino-sarcoma. (Epitheliosarcomes.)

Gross Pathologic Anatomy.—Why does malignant disease of the thyroid more commonly involve the right side? This may be mere coincidence. Most sarcomas of the thyroid develop deep in the substance of the gland and not at the surface. Encapsulation of the tumor enhances the prognosis at least 100 per cent.

Eventually the sarcoma pierces the capsule of the thyroid and infiltrates the trachea and the great vessels of the neck. Later it may extend substernally to infiltrate or ensheathe the aorta and its branches as well as the apex of the lungs.

Usually fibro-sarcoma is of harder consistency than the round-cell sarcoma. When its lobulated substance is sectioned, the cut surface is yellowish or grayish-white, but it may be reddish-brown in color if there are hæmorrhagic areas in its compages, or if the blood supply is well developed. Lymph nodes involved by metastases are hard and yellow on cross-section.

Microscopical Pathology.—The cells of a rapidly growing thyroid carcinoma may assume, sometimes, the shape of anaplastic undifferentiated cells, even to the degree of appearing spindle-shaped, in which event the tumor is incorrectly termed sarcoma. The differential diagnosis between scirrhus carcinoma and fibro-sarcoma of the thyroid is particularly difficult. Proof of the fibro-blastic origin of the tumor cells can be obtained by staining with phospho-tungstic acid-hematoxylin, if delicate fibrils are shown terminating each tumor cell.

Fibro-sarcoma, with which I am especially concerned in this article, is histologically less malignant than the other varieties of sarcoma. The large fusiform or spindle cells are usually arranged obscurely in interlacing bundles without definite architecture. The nuclei are frequently large, irregular, deep-staining and contain heavy chromatin filaments. The spindle cells in-

volve the interacinous connective tissue and trabeculæ of the glands. The thyroid vesicles or acini are surrounded by this tissue growth, which rarely intrudes into the lumina. The parenchymal cells of the acini are squeezed within the new tumor tissue and eventually undergo pressure atrophy and replacement by neoplastic cells. A small portion of these so-called fibro-sarcomas may have a neurogenic origin, although this is difficult to prove without necropsy evidence of visceral neurofibromatosis.

Histogenetically the mixed-cell sarcoma of the thyroid may be identical with the spindle-cell type. Microscopically it is characterized by the presence of large, polyhedral cells, which tend to be clumped in certain areas. The nuclei are large, irregularly shaped, frequently budding and have a heavy chromatin content. Langhans cells and cells approaching the myelopax type may be scattered throughout these tumors. Are these giant cells the ordinary foreign-body types of giant cells or are they derived from endothelial cells in the parietes of the blood vessels? Probably the latter hypothesis is correct as these giant multinucleated cells seem to line vascular channels having no other endothelium.

Concerning the carcino-sarcomas, L. B. Wilson [30] has this to say: "Beside their connective tissue elements in which any form of sarcoma cell may be the dominant one, although it is most frequently the spindle-cell type, there are also almost invariably present large or small groups of parenchymatous cells which show that they are also proliferating. Whether or not the neoplastic process started with the parenchymal elements which were later destroyed by a secondary proliferation of the connective tissue elements, or whether the process from the beginning was a proliferation of the connective tissue elements with only secondary stimulation of the parenchymatous cells as they are gradually squeezed out, it is impossible to say." Masson [18] recognizes a tumor called epitheliosarcome, which in the beginning is a thyroid carcinoma, but the stroma of which acquires sarcomatous properties and progressively outgrows the epithelial elements. This is not inconsistent with similar neoplastic occurrences, such as the occasional association of sarcoma of the uterus with corporeal adeno-carcinoma and the coexistence of sarcoma and adeno-fibroma of the mammary gland.

Metastases.—Binnie [3] reported a primary sarcoma of the thyroid with metastases to the humerus and to the small intestine. Morf reported two instances of metastases to the gastro-intestinal tract among a series of forty collected cases of sarcoma of the thyroid. Kobler [14] studied a spindle-cell sarcoma of the right thyroid lobe, which metastasized to liver, right kidney, and upper ileum. Pick [22] observed metastases in lungs, heart, liver, stomach, intestine, pancreas, dura mater and palate from a spindle-cell sarcoma of the thyroid. Becker [2] reported a giant-cell sarcoma of the thyroid which metastasized to lungs, pleura, and bronchial lymph glands. Muller and Speese [20] observed metastasis to the liver from a fibro-sarcoma of the thyroid. It seems that sarcoma of the thyroid gland metastasizes chiefly to lungs, liver, bone, kidneys and gastro-intestinal tract.

In some cases secondary tumors appear before patients and surgeons alike are aware of the tiny primary sites in the thyroid gland. For this reason, these have been termed the "latent" type. Sarcoma of the thyroid metastasizes more commonly by the blood vascular system, due to growth invasion into the thyroid veins. Only at a later stage of the disease, are the lymphatic pathways implicated in the dissemination of sarcoma cells. In primary sarcoma of a lateral lobe of the thyroid, especially of its outer and posterior portion, the lymph node metastases first occur along the internal jugular vein. When the primary disease is situated in the isthmus or in the anterior and internal part of a lateral lobe, the lymph glands in the mediastinum are first affected. Occasionally, such an enlarged lymph gland can be palpated within the supersternal space of Burns.

Irradiation Treatment of Thyroid Sarcoma.—Perthes [21] believes that sarcoma of the thyroid is as favorable for this form of treatment as sarcoma of the lymph nodes or of the tonsils. On the contrary, it has been Schädel's experience that sarcoma of the thyroid, whether of the spindle-cell, polymorphous-cell or lymphoid-cell type, does not react well to irradiation. Schädel [23] does state, however, that the primary sarcomatous lesions respond more readily to X-ray or radium therapy, than the secondary or metastatic tumors. The radio-sensitivity of thyroid neoplasms increases in the following order of ascendancy: fibro-sarcoma < carcinoma < mixed-cell sarcoma < round-cell sarcoma.

The relative radio resistance of fibro-sarcoma is due to its fibrous character. It is for this reason that radium therapy is preferred to X-irradiation, because the former exerts a strong action directly on the tumor cells, whereas the latter injures indirectly to some extent by vascular and connective tissue changes. Moreover, if the growth is well localized in the thyroid, radium is preferable to X-ray because the latter method tends to injure the remaining normal thyroid tissue. Parathyroid tetany has followed heavy generalized irradiation of the thyroid region.

The metastases in the later stages of the disease are not controlled well by irradiation. For such cases, X-ray therapy is a more suitable palliative measure. Irradiation for thyroid sarcomas may be (*a*) post-operative (prophylactic), (*b*) pre-operative, (*c*) complete treatment for inoperable cases (palliative).

Interstitial radium therapy can be applied in several ways. A post-operative drainage tube inserted in the wound bed may contain radium capsules *in tandem* to give about 650 millicurie hours (Bowing).[5] After surgical exposure of the tumor mass, steel needles containing radium salt or emanation may be placed in parallel arrangement throughout the lesion. The filter in such a case is the equivalent of 0.5 millimetre of silver. Radön implants in the form of gold or platinum "seeds," with filtration of 0.3 millimetre, can be inserted into the tumor by means of hollow needles and stylet.

External irradiation by means of a radium pack or moulage applicator or

by X-ray can be given to the limit of skin tolerance. In post-operative cases, such treatment should be withheld until the incision is healed.

The Surgical Treatment of Thyroid Sarcoma.—The cures reported for sarcoma of the thyroid occurred in those instances where the discovery of sarcoma was made by pathological examination after an operation for presumably benign goitre. This represents malignancy in a preclinical stage and naturally is the only type which affords a happy prospect of cure. Still other sarcomas slightly more advanced in degree, are only identified and recognized as such when the surgeon attempts to remove them.

A radical operation for palpable, extensive and clinically malignant tumors of the thyroid gland is impossible, because the entire thyroid gland with the parathyroid bodies cannot be completely removed. However, surgical treatment, palliative in nature, such as tracheotomy and lobectomy are justified, as such measures tend in certain cases to prevent or delay death by the local effects of the tumor. Block dissection of the lymph glands of the neck is not as important a procedure in sarcoma as in carcinoma of the thyroid, but this cannot always be foretold even with the help of frozen section biopsical diagnosis, in the event that a one-stage operation is planned.

The best incision for exposure is the usual semi-lunar one. This permits the insertion of a tracheotomy tube also, if this is necessary. If the tumor is definitely unilateral, some surgeons occasionally make an incision along the anterior border of the sternomastoid muscle. One entire lobe and half the isthmus (all within an intact capsule) are removed. No attempt should be made to enucleate the malignant tumor. The surgeon must be particularly cautious about ligation of the veins because of the danger of sarcoma-cell embolic metastasis.

Results.—Patients with sarcoma of the thyroid proceed to a more rapid lethal termination than do those with carcinoma of the same gland. The usual expectancy is two or three years after the inception of the disease. Herbst [12] makes the following comment: "The mortality, then, is practically 100 per cent. It seems that sarcoma of the thyroid proceeds to a fatal end about as rapidly as any malignant condition known." A. Kocher [15] states that sarcoma of the thyroid recurs in 100 per cent. of all cases subjected to operative removal. Wilson [30] gives six months as the average post-operative length of life for sarcoma of the thyroid gland. This disease, then, is almost invariably fatal and the cures by surgery alone are fortunately accidental rather than consciously intentional.

Case Report.—H. D., a male, aged 56 years, applied for diagnosis and treatment on August 14, 1928.

Family History.—The patient was one of thirteen children. All of these were in good health with the exception of the patient and one sister who died of some obscure disease. There was no history of cancer in the immediate family. His mother died of senility, but had a life-long adenomatous benign goitre. His daughter has a slight enlargement of the thyroid gland.

Previous History.—Since youth, his thyroid was noticeably and palpably enlarged. No treatment was given because this goitre caused no toxic or local pressure symptoms.

Chief Complaint.—Aphonia and increased growth of thyroid gland.

Present Illness.—One week ago the patient suffered a complete loss of voice. During the past year his neck had undergone gradual enlargement. There were no loss of weight, no pain and no other symptoms. His appetite and ability to sleep were unimpaired.

Physical Examination.—The patient was a well-nourished male of late middle age. His neck measured 44½ centimetres in circumference at the centre. At the base of the neck the circumference was 46 centimetres. The thyroid was palpably enlarged and nodular in character, particularly the right lobe. Fig. 1.) There was no evidence of hyperthyroidism; no tremor; no ocular signs.

FIG. 1.—Pre-operative film of chest on June 26, 1928, prior to treatments. No definite sign of lung involvement.

Laryngeal Examination.—There was a complete loss of motion of all of the structures on the right side of the larynx, indicating a paralysis of the right recurrent laryngeal nerve. The lumen of the larynx is not visibly encroached upon by infiltration of the thyroid tumor, but the glottic space is somewhat decreased by the paralysis of the vocal cord.

Primary Irradiation.—From August 16, 1928, to August 30, 1928, eight X-ray treatments were given over the neck in areas marked A, B and C. The usual factors were 180 kilovolts, 4 milliamperes, 40 centimetres anti-cathode-skin distance, 0.5 millimetre of copper filtration, 45 to 60 minutes exposure and fields of 10 x 16 centimetres.

August 28, 1928. The thyroid gland was irradiated by the use of a radium "pack." (External radium therapy at a distance.) The focal distance was five centimetres; the filtration was two millimetres of brass and the dosage 18,837 milligram hours.

By August 31, 1928, the thyroid tumor had diminished somewhat. The circumference of the centre of the neck was now 42¼ centimetres, and the base of the neck 44 centimetres.

Operation.—September 13, 1928. A partial thyroidectomy was done. Because of the mobility of the thyroid tumor, it was believed that it could be extirpated completely by surgery. Some apparently normal thyroid tissue remained. In the course of the operation, the growth was found to be irremovably adherent to the larynx, so that necessarily some of the tumor tissue was left behind.

Pathological Report.—September 13, 1928. The specimen consisted of a large lobulated mass measuring 7 x 7 x 4.45 centimetres in thickness. No definite capsule could be made out although in one or two small areas on the surface a thin capsule-like tissue could be stripped off, however, tearing easily and showing firm adherence to the under-

lying tissue. The mass was irregularly nodular. On section, the cut tissue was yellowish white. At one pole was a partially circumscribed ovoid mass 3.5 centimetres in diameter showing an almost stony hard consistency. Fresh sections showed an apparently striated whitish tissue with numerous translucent areas and many yellowish foci, some of which gritted on cutting. The remaining tissue of the mass surrounding the nodule described was of similar appearance but of a softer consistency. There was no evidence of thyroid tissue in this mass. The cut tissue on handling exuded a small amount of translucent glairy fluid. Attached to the mass was a small lobule, 2 x 1 x 1 centimetres, of pinkish thyroid tissue which appeared continuous with the underlying whitish tissue described above and which showed small irregular strands infiltrating the tissue. There was a small circumscribed discrete, apparently secondary nodule of firm white tissue. The third and fourth pieces of tissue were small in size and similar to the tissue described in the primary mass.

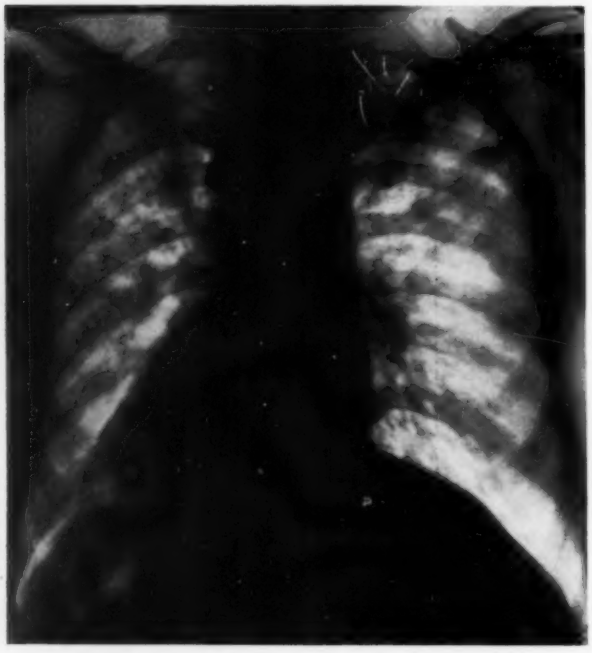

FIG. 2.—Post-operative film of chest on November 9, 1928, showing lung metastases, displacement of trachea with soft tissue swelling anterior to it.

Tissue for frozen section examination was taken from the large nodular adenoma-like mass described above and from the remainder of the primary mass near the opposite pole. Both of these sections presented essentially an identical histological picture. The predominating tissue was a completely non-cellular, coarsely fibrillar or collagenous tissue. At one edge of the section was a similar coarsely fibrillar tissue studded with many hypertrophic and hyperchromatic polymorphous nuclei, the predominating form being fusiform. An occasional mitotic cell was seen in every two or three microscopic fields. Some of the nuclei showed pyknosis. The fibrils ran in every direction forming many interstitial spaces, some of which showed a pale greenish blue stain (mucin-reaction). There was no demarcation between the non-cellular and cellular tissue, the latter, in fact, being continuous with the non-cellular tissue and showing a diminishing extension of nucleated fibrils from the cellular into the non-cellular area.

Sections for paraffin preparation included six representative areas covering the entire specimen. Most of these sections showed a coarsely fibrillar and collagenous compact nucleated tissue which appeared uniform, solid throughout. The nuclei of this tissue showed extreme variation in size and shape, some being hyperchromatic, others vesicular and many of the nuclei showing pyknotic changes. There was a considerable number of multinucleated cells. From many of the nuclei coarse eosinophilic fibrils could be seen extending from the poles of the nucleus, in some instances being tripolar. This tissue in some sections showed very marked mitotic activity and multiple scattered discrete areas of loose, areolar, nucleated, finely fibrillar tissue suggesting mucin secretion. There were also multiple scattered discrete areas of non-nucleated fibrillar tissue suggesting necrobiotic changes. Section of the growth in the region of the

thyroid tissue described above exhibited an occasional small intact thyroid acinus, some showing colloid secretion and embedded in the fibrillar tissue. The separate small nodule described in the gross consisted of similar highly nucleated compact fibrillar tissue with multiple areas of mucin secretion (so-called "myxomatoid" changes). Variations in the size and shape of the nuclei in this section as well as in one or two other sections were most extraordinary. The vascularity of the predominating fibrillar tissue was slight. No definite thrombosis could be determined, nor was there any definite evidence of calcification.

The pathologic diagnosis was fibro-sarcoma of the thyroid, involving a complete lobe with increase in growth to about twice the normal size of the lobe and showing secondary mucinous, necrobiotic and autolytic degenerative changes. The growth appears to be actively invasive.

Report of Microscopic Examination by Dr. Joseph Colt Bloodgood.—Histologically, the very remarkable feature was the very large amount of eosin-staining stroma in the mesh work of which were single cells and now and then two or three cells but no large nests. In many places there were cavities without cells. More of these cells were forming colloid vesicles or colloid material. The morphology of the cell varied, spindle and stellate cells predominating. Whether this was the true nature of the tumor or a change from radiation it is impossible to say. I am of the opinion that it was an old fibroma which had become a fibro-sarcoma, and there was some destruction of the cells due to radiation. Entire colloid vesicles were surrounded by tumor. It was more of the tumor infiltrating thyroid than of thyroid tumor. These are slow-growing tumors.

FIG. 3.—Low power photomicrograph of fibrosarcoma of the thyroid. Note interlacing bundles and architectural confusion.

Course of the Disease.—September 13, 1928.—Loss of twenty pounds in weight.

September 24, 1928.—Chest röntgenogram was negative for metastases.

October 23, 1928.—Hæmoglobin was 75 per cent. Because of this and general debility, a blood transfusion was given of 1000 cubic centimetres.

November 11, 1928.—Another blood transfusion (1000 cubic centimetres) was given. There were two short periods of hæmoptysis, presumably due to perforation of the trachea and larynx by the malignant growth. Intermittent radiating pains occurred in neck and chest. Coley's mixed toxin had been given intramuscularly (Miii); followed by acute chill and rise of temperature to 103 F. The hæmoglobin percentage was now 80 per cent.

November 9, 1928.—Coley's toxin (Miii) intramuscularly caused a chill and fever of 103 F. Consultation with Drs. W. B. Coley and Lloyd F. Craver, whose joint opinions were that the prognosis was hopeless. By this time, there were obviously pulmonary metastases. Continued palliative irradiation and inoculation of Coley's toxin were the measures decided upon for subsequent treatment.

November 24, 1928.—Hæmoptysis. The hæmoglobin was still 75 per cent.

November 25, 1928.—Continued expectoration of blood and marked asthenia now predominated the clinical picture. There was obvious recurrence of the malignant tumor at the primary site. Another transfusion of 1000 cubic centimetres of blood was given for palliation.

December 1, 1928.—Coley's toxin again started, commencing with 3M, and each day

increasing the dose by one minim. On December 3, 1928, the patient's temperature was 100.4 F. without toxin. There was continual loss of weight and strength.

December 5, 1928.—The patient now complained of severe pain in the lumbar region, radiating along the spinal column. The hæmoglobin was now 68 per cent.

December 9, 1928.—A rapidly growing recurrent radio-resistant tumor mass now appeared on the right side of his neck. Another blood transfusion of 1000 cubic centimetres was given, but the patient continued weak and complained of severe pain. The laryngo-tracheal infiltration of the sarcoma was now sufficient to cause severe dyspnœa.

December 17, 1928.—He now vomited dark brown fluid and expectorated bright red sputum.

December 20, 1928.—The liver was grossly enlarged; it extended into his pelvis. The pain in neck and back became excruciating.

December 26, 1928.—Hæmaturia was now apparent. At this stage, there were

FIG. 4.—High power photomicrograph of fibrosarcoma of thyroid. Illustrating the predominant fusiform cell.

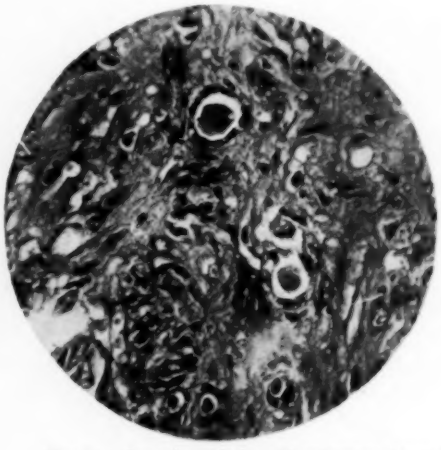

FIG. 5.—Invasion of thyroid substance by the fibrosarcoma with resultant displacement and pressure atrophy of the thyroid acini.

obviously metastases of the lungs, bones, liver, kidneys gastro-intestinal tract and cervical lymph nodes.

December 28, 1928.—*Exitus lethalis.* Death occurred sixteen months after the onset of recognizable signs of increased growth of the goitre, and three and one half months after operation. Necropsy was refused.

Post-Operative Irradiation.—With the high-voltage X-ray he was given the following number of treatments over each area (period September 26, 1928, to November 28, 1928) A-1, B-1, C-12, D-5, E-6, H-3, M-3, N-3.

With external radium therapy the following applications were given, on October 22, 1928: (*a*) To neck anteriorly, one centimetre distant, two millimetres of brass filtration, 3,120 milligram hours. (*b*) To left chest anteriorly at 1 centimetre distance, same filter, 3,650 milligram hours. (*c*) To left chest anteriorly at two centimetres distance, same filter, 7,440 milligram hours.

SUMMARY

Fibro-sarcoma of the thyroid gland is a rare and fatal disease. The initial response to irradiation may be favorable, but the sarcoma rapidly metastasizes by the blood vascular system to thoracic and abdominal viscera. A typical case of this malady is herein reported.

We have recorded seventeen cases of sarcoma; seven in males and ten in

females ranging in age from twenty-five to sixty-one years. Duration of nodule or irregular enlargement of the thyroid from one month to twenty-five years. In all cases from one to eight months there was a rapid increase in size, or change in swelling of the neck. Duration of life following incomplete operation ranged from a few hours to one year, with the exception of one case which has just been operated on for the relief of tracheal pressure. Sarcoma represent about .6 per cent of all cases.

Diagnosis made were mixed-, round- and spindle-cell sarcoma, lymphosarcoma and round-cell sarcoma, with the greatest number of mixed cells. Metastases to axilla, lungs, bronchial glands, liver, trachea and œsophagus, and one especially interesting case in which we had tumor of the thyroid, tumor of the breast of the same character, with the extension to the œsophagus and trachea, with metastases at no other place. Radium and X-ray were used in several cases and seemed to hold growth in check for a time.

BIBLIOGRAPHY

[1] Allen, D. P.: ANNALS OF SURGERY, June, 1897.

[2] Becker, R.: Giant-cell Sarcoma of the Thyroid Gland. Brun's Beiträge zur klinischen Chirurgie, vol. cxxxviii, pp. 76–81, 1926.

[3] Binnie, J. F.: Malignant Neoplasm of the Thyroid with Metastases in the Intestine and the Bone, Surg. Gynec. and Obstet., vol. xxvi, pp. 288–291, 1918.

[4] Bloodgood, J. C.: Surg., Gynec. and Obstet., p. 121, February, 1906.

[5] Bowing, H. H.: Malignant Tumors of the Thyroid Gland, Treated by Operation, Radium and Roentgen Rays, The Amer. Jour. of Roentgenology and Radium Therapy, vol. xviii, No. 6, pp. 501–508.

[6] Bowlby, A. A.: Infiltrating Fibroma (Sarcoma?) of the Thyroid Gland, Lancet, vol. ii, pp. 1001–1002, 1884.

[7] Chambers: Arch. Middlesex Hosp., vol. xv, p. 29, 1909.

[8] Craver, L. F.: Cancer of the Thyroid and Its Present Day Treatment, ANNALS OF SURGERY, pp. 833–853, December, 1925.

[9] Crotti, A.: Thyroid and Thymus (Pathology, chap. iv, p. 93), Lea and Febiger, Philadelphia and New York, 1922.

[10] Eberts, E. M., and Fitzgerald, R. R.: Malignant Disease of the Thyroid Gland, ANNALS OF SURGERY, pp. 515–531, October, 1927.

[11] Ehrhardt, O.: Zur Anatomie and Klinik der Struma Maligna, Beitr. z. klin. Chir., vol. xxxv, p. 343, 1902.

[12] Herbst, W. P., Jr.: Malignant Disease of the Thyroid, ANNALS OF SURGERY, vol. lxxix, p. 488, April, 1924.

[13] Klose, H., and Hellwig, A.: Die Struma Maligna, Klinische Wochenschrift, vol. i, p. 1687, August, 1922.

[14] Kobler: Wien med. Wchnschr., No. 9, 1886.

[15] Kocher, A.: Article in Zweifel-Payr, Klinik der bosartigen Geschwülste der Schildrüse, Deutsche Zeitschrift für Chirurgie, vol. xci, p. 197, December, 1907.

[16] Lartigau: Amer. Jour. Med. Sciences, vol. cxii, p. 156, 1901.

[17] Limacher: Virch. Arch., p. 151, 1898.

[18] Masson, P.: Les Tumeurs, p. 370, A. Maloine et fils, Paris, 1923.

[19] McNerthney, J. B.: Sarcoma of the Thyroid, Surg. Clin. of N. A., vol. vii, pp. 1181–1187, October, 1927.

[20] Muller, G. P., and Speese, J.: Malignant Disease of the Thyroid Gland, Univ. of Penn. Med. Bull., vol. xix, pp. 74-88, 1906–7.

[22] Pick: Ztschr. f. Heilk., vol. xiii, 1892.

[25] Schädel, W.: Ueber Struma Maligna, Münchener medizinische Wochenschrift, vol. lxix, p. 1282, September 1, 1922.

[26] Simpson, W. M.: A Clinical and Pathological Study of Fifty-Five Malignant Neoplasms of the Thyroid Gland, ANNALS OF SURGERY, vol. iv, pp. 643–667, February, 1926.

[25] Speese and Brown, H. P., Jr.: The Malignant Degeneration of Benign Tumors of the Thyroid Gland, ANNALS OF SURGERY, vol. lxxiv, pp. 684–690.

[28] Tebbutt, A. H., and Woodhill, V. R.: Tumors of the Thyroid Gland, Medical Journal, Sidney, Australia, vol. i, supp. 12, pp. 353–358, 1927.

[27] Tiffany, L. McL., and Lanier, B. B.: Primary Sarcoma of the Thyroid Gland, ANNALS OF SURGERY, vol. xxvi, pp. 498–503, 1897.

[28] Tillaux: Quoted by Speese and Brown.

[29] Waring, H.: The Surgical Treatment of Malignant Disease, Oxford Univ. Press, pp. 349–368, 1928.

[30] Wilson, L. B.: Malignant Tumors of the Thyroid, ANNALS OF SURGERY, vol. lxxiv, pp. 129–184, 1921.

[31] Young, A. R.: A Colloid Tumor and a Sarcoma, China Med. Jour., vol. xxiv, p. 273, July, 1910.

EXTRAPLEURAL THORACOPLASTY DURING THE TREATMENT OF PULMONARY TUBERCULOSIS*

By Adrian V. S. Lambert, M.D.
and
Frank B. Berry, M.D.
of New York, N. Y.

During the past decade a voluminous literature has accumulated in regard to the treatment of pulmonary tuberculosis by thoracoplastic collapse of the lung. A number of different opinions have been expressed and minor controversies have arisen concerning technical details of the procedure, but the testimony is unanimous—among surgeons at least—that the operation is beneficial in wisely selected cases. Many of us have crystallized our ideas sufficiently to warrant this presentation to a group of general surgeons such as comprise the membership of this society. It is not our purpose or intention to discuss at length the merits of the various controversies but simply to offer our conclusions, based as they are on a long, and at times a bitter, experience. There are phases of the subject on which we cannot dogmatize, because we are in doubt as to their solution.

During the ten years much has been learned, and by means of a constant follow-up system and from a searching consideration of the causes for our failures we have reached some definite conclusions which we hope to elucidate.

We have been closely associated in this work with Dr. James Alexander Miller and his assistants, and have leaned heavily upon them, not only for pre-operative advice in the selection of cases and for their post-operative care, but also for instruction in the principles of the modern treatment of tuberculosis, and much of the knowledge we possess is due largely to them. We wish here not only to acknowledge this debt and to express our appreciation but also to emphasize to every surgeon who may contemplate the care of the tubercular patient the necessity of becoming associated with some one who is familiar with and interested in the details of the treatment of pulmonary tuberculosis, and who from his knowledge can form a reliable judgment in respect to the prognosis and ultimate fate of any particular patient. The importance of this has been repeatedly stressed by most workers in this field. In this connection we wish to disabuse the minds of those who, unfamiliar with the subject, may consider that these operations are per se curative measures. They are not. Quite the contrary, they should be looked upon only as incidents, often important in the course of treatment of the pathological processes, which simply alter the local conditions, whereby the balance is changed in favor of the patient in his fight against the disease. His resistance, which under the former conditions was unable to combat the

* Read before the New York Surgical Society, November 13, 1929.

disease successfully, can under the new and changed circumstances overcome and heal or arrest the tubercular lesion. We do not remove the diseased tissue. He is still suffering from tuberculosis and must undergo a more or less prolonged course of treatment to effect a cure.

All these operations place an added burden on an already sick person, and therefore in contemplating an operation in any case, we must consider two factors: Can the patient withstand the immediate shock of the operation, and will the procedure so influence the lesion that it will be able to heal?

The operations we have under consideration are first, the thoracoplastic collapse of the lung by means of the subperiosteal, and therefore the extrapleural, removal of the posterior portions of the ribs from and including the first to the tenth or eleventh; and second, the division of, or removal of a portion of, the phrenic nerve, where it lies on the scalenus anticus muscle in the neck. We shall consider this latter only in connection with cases in which rib resection has been already performed, or in which such an operation is contemplated. The consideration of its value as an independent procedure would lead us too far afield in this paper.

We are in complete agreement with those writers who believe that the thoracoplastic operation should be done in two or more stages, and that it is hazardous to remove all the ribs at one stage. We attempted the latter during our early experience with discouraging results. There was a 25 per cent. operative mortality within the first two weeks post-operative, and 14 per cent. late mortality. It was simply a question of too much operation. Even in some of the cases in which the procedure was divided into two stages we have had the same result. It is always a temptation to continue an operation if the condition of the patient at the time is reported excellent, but in these cases it is better to err on the safe side as otherwise the results may prove disastrous. The cause of death in such cases has been variously attributed to "shock," "mediastinal shift," or "flapping of the mediastinum."

It is still a matter of opinion whether the upper or the lower ribs should be removed first. We feel we can secure a greater degree of collapse by removing the upper ribs first, believing that we cannot obtain the full benefit from the fall of the ribs until the first rib has been taken out. It is an academic question, if the second stage can follow the first before the resected portions have begun to regenerate, which is usually well established within a month or six weeks. This question takes on an added significance if the second stage must be deferred for several months, because by this time the resected portion of the chest wall (which in the upper limits is held out by the curve of the ribs above it) has become so stiffened and fixed that the fullest degree of collapse is not obtained after the second stage.

It has been maintained recently (especially by some French writers) that equally good results may be attained by the removal of the posterior axillary portion of the ribs as by the removal of their extreme posterior portions. We are firmly convinced that this is erroneous. We feel sure that the lack of success in certain cases is due to this failure to remove the extreme

posterior ends of the ribs, especially in cases with large cavities. We unreservedly advocate dividing the ribs as close as possible to their attachment to the transverse process of the vertebræ; because only in this way can we obtain the complete collapse of that portion of the lung which is situated in the gutter bounded mesially by the bodies of the vertebræ, and posteriorly by the vertebral transverse processes and the acutely arched ribs. In this connection it is important to bear in mind that it is much easier and less hazardous to carry out the proper procedure at the first operation (when the tissues are comparatively normal and the rib removal is relatively simple) than it is to attempt a revision of a case after the new bone has formed with various boney plates, and the pleural attachments have become thickened, extremely vascular and densely fibrous. We have attempted a revision in five cases, two of them being our own early ones. Of these five two died, one from pneumonia and one as the result of hæmorrhage and infection. In all of them the operation was difficult and prolonged and the bleeding was profuse.

We usually remove from ten to twelve centimetres of the lower ribs and a gradually diminishing amount as we proceed upward. From one to two centimetres are removed from the first rib.

As these wounds are of wide extent, and a dead space necessarily remains beneath the large flap, a careful hæmostasis should be carried out, and every vessel which may require a hæmostat should be ligated. We drain the dead space beneath the flap with the empty cover of a cigarette drain, which is removed at the first dressing on the third or fourth day post-operative.

In our earlier cases we divided the phrenic nerve only when a cough persisted, with or without positive sputum, after a complete thoracoplastic collapse had been accomplished. Of late we have divided the phrenic as a preliminary step to the procedure and have come to believe that this is the proper sequence. A more gradual collapse of the lung can thus be obtained and we can gain valuable information as to whether the patient will be benefited by a more extensive collapse. The operation is a simple one, performed under local anæsthesia, and often will alter the local conditions sufficiently to allow the patient to combat his disease so successfully as to render him a far better operative risk. In certain cases the improvement has been so striking that we have refrained from further operations, but as these cases are still under observation we are unable to report on the final outcome, and have not crystallized our opinions sufficiently to reach a conclusion as to its permanent value.

Our series of cases shows that the condition of the contralateral lung is of vital importance and that it is difficult in the extreme to form a correct estimate of the significance of the X-ray evidence of former disease.

Of the twenty-four operative deaths in the series, sixteen were in bilateral lesions and seven of these were due to an immediate spread or reactivation of the disease in the contralateral lung, while there was only one such case among the eight operative deaths in the unilateral group.

We think that an important factor in promoting this reactivation of what was often considered a quiescent or healed lesion is due to a tuberculin reaction. The release in the circulation of a certain amount of tuberculin from the manipulation and sudden collapse of an extensive lesion is frequently the cause of a sharp, sudden post-operative rise in temperature. Any case with distinct evidence of disease on the opposite side has a poor prognosis whether the lesion seems to be quiescent or not.

We have taken as a criterion of whether a case is active or quiescent the sole symptom of fever, and have disregarded in this connection any slight hæmoptysis or streaking. It is difficult and often impossible to estimate the importance of a slight hæmoptysis. It is certainly always a danger signal and a distressing symptom to a patient. There are many cases in which it is the only symptom of activity (if it is a sign of activity) and it may occur unaccompanied by fever or other signs of toxæmia. Each case must be considered by itself. From the standpoint of operation alone it does not appear to present any added risk.

The choice of an anæsthetic is of great importance. We have employed nitrous oxide and oxygen, ethylene and oxygen, local anæsthesia, and spinal anæsthesia with spinocaine. These each have advantages and disadvantages in this type of case. Certain patients are so nervous and apprehensive that a general anæsthetic is less of a strain than is a local one. Nitrous oxide if well borne is an excellent anæsthetic but there are patients who take it badly, have a pronounced cyanosis accompanied by marked inspiratory dyspnœa, which places a great burden on the right side of the heart. Many of these patients have been leading a sedentary life; their heart muscle has lost much of its normal tone, and is flabby. This burden on the heart may result in a dilatation with serious consequences.

We have noted no ill effects from ethylene. It does not cause cyanosis, is non-irritant and has no bad late affects. However the danger of explosion during its use has been stressed and advertised to such an extent, and its use has been forbidden in so many hospitals, that we have not been allowed to use it as generally as we would wish.

In view of these conditions we employ local anæsthesia as much as possible, but from time to time meet with cases in which the pleura is so firmly adherent to the ribs that a complete anæsthesia cannot be obtained and we have had to supplement it with nitrous oxide and oxygen.

Because of the glowing reports of spinal anæsthesia we were persuaded to try it, and have to report a death from its use. In confidential conversation with several men who have had experience with it in other conditions we find that this is not a unique case though we have failed to find many of them reported in the literature.

This class of patients withstands a pyogenic wound infection extremely badly and yet undergoes the ordinary operative procedure astonishingly well. As their wounds are extensive the infection is apt to be severe. In our series we feel that three cases of death are directly due to this cause and that in

three others the fatal spread to the opposite side was directly dependent on it, because it lowered the resistance of the patient to his disease.

In this day and generation it may seem strange for anyone to try to establish an alibi for a post-operative infection when we all know that careful technic and prophylaxis is the answer, but we would like to stress certain important elements which we think have determined in a measure the high mortality in this series of cases. Most of these cases have been cared for in hospitals where the immediate post-operative care has not been as intensive as in some other institutions in which the personnel has been larger, and we feel that some of the infections have occurred from displaced and disordered dressings, especially because we have had no serious complication of this nature in private work. The same applies to other complications which have proved fatal. We must remember that the act of coughing is a difficult and painful process following one of these operations, and a nurse who is in constant attendance can often do much to aid the patient in accomplishing this important act. Its importance will be patent to everyone if he will but remember that there is often a large amount of thick, tenacious sputum suddenly emptied into the bronchial tree from the collapsed cavities of the tubercular lung, and that this must be removed by coughing.

Five of our cases died as a direct result of this condition; one seemed to be virtually inundated by this secretion, and four others from a massive collapse. We have had six cases in all of massive collapse; four times in the contralateral lung and twice in the lower lobe after resection of the upper ribs of the same side. This complication has not apparently been noted by others,* and we feel it may have been confused with what was considered a shift of a movable mediastinum. The two conditions have many physical signs in common—displacement of the heart, diminished or absence of breath sounds over the lower lobe, rapid, thready pulse, marked dyspnœa and cyanosis. An X-ray will readily distinguish between the two conditions as the atelectatic lung throws an opaque shadow. We have attempted to prevent its occurrence by having the patient lie on the operated side and by encouraging coughing. This complication has occurred as early as a few hours after operation and as late as the third day. It is a serious development and careful nursing is an invaluable aid both in its prevention and treatment. We have not employed bronchoscopy for its relief.

One of our cases died during operation when on wounding the thin pleura (which resulted in a partial pneumothorax over a very limited area), the patient's heart suddenly stopped beating and all efforts at resuscitation failed. This accident resembles those occurring on the induction or during a refill of a pneumothorax. In all our experience we have had two similar deaths on introducing a needle into a nontuberculous lung abscess through an open wound of the chest wall preparatory to drainage. Being ignorant of the exact cause of death in these cases we speak of it as "pleural shock,"

* Berry, F. B., Archives of Surgery, vol. xviii, p. 257, 1929.

a term which has many objections but which at least has this advantage: It does not assume a definite pathology. Some have attributed it to air emboli. This may be the correct etiology.

In this series there have been a number of cases which today we would consider bad risks, and others poor risks, and we would refuse to operate on some and hesitate long before attempting others. As has been stated all cases with a lesion in the contralateral lung are doubtful risks as are also cases which at the time of the operation are running a fever or losing weight.

The group of cases best suited for this procedure is the more or less chronic type with a fibrotic lesion which is confined to one lung and quiescent. A second group which does well comprises those with a fibrotic lesion which only show signs of activity, fever, increased cough and loss of weight on attempting any degree of active life. A less favorable type, but one in which the procedure has proved beneficial, includes those cases which have a chronic fibro-caseous lesion. Here, however, one must proceed with greater caution and divide the operation into several stages in order to collapse the lung more gradually. (In these groups pneumothorax treatment is precluded owing to adhesions between the lung and the parietal pleura.)

A fourth group which has done well is that in which a pneumothorax has been only partially successful in collapsing the lung due to the presence of extensive adhesions, usually in the neighborhood of large cavities; because these cavities are held open and their collapse prevented. These patients may have improved up to a certain point, but continue to have positive sputum and run a temperature at times on too great activity.

We have purposely omitted from all consideration the cases of tuberculous empyema in the treatment of which this operation has been performed, believing that in these instances the lung is already collapsed and that these present a totally different problem.

The following table summarizes the results in this series of one hundred cases. There were one hundred and fifty-two thoracoplastic operations.

Results in 100 Cases

	Total	Op. Death	Late Death	Post-op. Hæmoptysis	Cured	Imp.	Unimp.	Imp. (lost)
Unilateral....	64	8 (12%)	7 (11%)	1	23 (36%)	16 (25%)	5	4
Bilateral.....	36	16 (44%)	9 (25%)		4 (10%)	5 (14%)	2	

Cured or arrested cases are those who are free of all symptoms after two years and are leading an active life.

The improved cases are those who have been observed for less than two years, some of whom are leading an active life, and some of whom are still undergoing a cure but are considered to have a good prognosis.

The unimproved group comprises those whose sputum is still positive and

who continue to show signs of active tuberculosis. A small group has been lost sight of. They were considered to be doing well when last seen, following a period of observation from six to eighteen months.

In estimating the value of thoracoplasty we are confronted by many considerations which are subject to varied interpretations. There are a number of factors which determine the success of operation after the wounds are healed and the patient has passed beyond the immediate care of the surgeon. All these patients still have tuberculosis and they must undergo a rigid, carefully supervised regimen or cure. Part of our lack of success would seem to be directly attributable to the failure of patients to realize the importance of this. Many of them become convinced that they are cured and look upon further hospitalization as an unnecessary hardship and so return to work too soon in spite of all our efforts at dissuasion. They have lost their cough, have gained weight, and have a feeling of well-being which they have not had for years and which without doubt gives them a false sense of security.

Among the class of patients here considered there are many in whom the economic pressure is such that they feel they must return to their duties in their homes. There are others whose ignorance is so great that no amount of argument has any influence on them, they simply do not believe that they are not completely cured and not out of danger.

All the cases require at least a six months' after-cure and some a considerably longer one. They should be watched most carefully and it is here again that the surgeon must depend on the judgment and sagacity of the medical colleague coöperating with him in this work. We have had patients free of all symptoms and leading an active life for five years, who have died of some cause other than their tuberculosis. On these we have been fortunate enough to obtain a post-mortem examination. In the completely collapsed lung there still remained a few nodules well healed, it is true, but which on microscopic examination proved to be large tubercles, "locked up," or "arrested" if you prefer, but still a possible source of danger. One patient who had been free of all symptoms and had led an active life for two and a half years, suddenly without warning had an enormous fatal hæmoptysis and died within five minutes. Several of these cases have undergone more or less severe operations, for acute appendicitis; strangulated hernia, curetage, and have continued well. Most of them, however, have taken, subsequent to this ordeal, an after-cure of several months. Two of our cases have, against our advice, successfully gone through a pregnancy without apparently any ill effects.

We mention these facts in order to emphasize the necessity of keeping these patients constantly under supervision and it would seem that in no class of cases is the value of a follow-up system of greater importance.

The first case on whom we operated lived seven years. During this time she led an active life as a switchboard telephone operator and died of an acute intestinal obstruction from a peritoneal band. We have others con-

sidered as cured who are taxicab chauffeurs, school teachers, secretaries, social workers, and in other active occupations. If these patients remain quiescent for two years they usually continue to do extremely well.

Finally we would impress on your minds what was mentioned early in this paper, the absolute necessity for the surgeon to be associated with some one familiar with the care of tuberculosis, and reiterate again that these operations are only incidents in the cure of those suffering from pulmonary tuberculosis.

The general surgeon in forming an estimate of the value of this operation should realize that these cases are not curable by any known conservative treatment, that many are condemned to a life of invalidism and in addition are a constant menace to the health of others because of their positive sputum and that the majority will eventually die of this disease.

The operation has had real value in their treatment because 33 per cent. of all cases have been returned to an active, useful life of from two to seven years. This compares favorably with any statistics we have seen of gastrectomy for carcinoma or excision of the rectum for cancer, and yet is there anyone who would hesitate to operate on such cases? The mortality rate can be reduced by a more careful selection.

For Discussion see page 126.

CHANGES IN THE INTRAHEPATIC BILE DUCTS FOLLOWING CHOLECYSTECTOMY

By John E. Sutton, Jr., M.D.
of New York, N. Y.

From the Department of Surgical Research, Cornell University Medical College. This work was aided by a gift from Mrs. John L. Given in support of surgical research

Embryologically the gall-bladder, liver and bile ducts are closely related. In the three-millimetre embryo the liver anlage is distinguishable as a longitudinal groove in the ventral surface of the foregut just below the stomach. From the upper portion a solid mass of cells grows into the septum

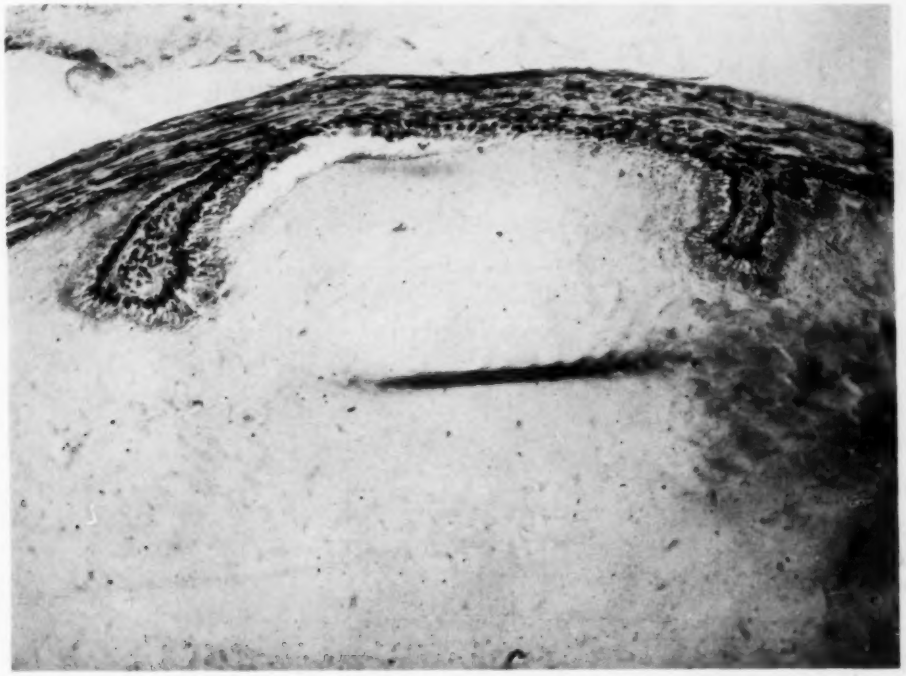

Fig. 1.—Normal gall-bladder wall from a dog.

transversum, forming the liver, while the lower part remains hollow and gives rise to the common bile duct, gall-bladder and a portion of the hepatic ducts.

The adult human hepatic, cystic and common bile ducts are all lined with simple low columnar epithelium with occasional goblet cells; while the gall-bladder is lined with a folded mucus membrane covered with tall columnar epithelial cells similar to those of the intestine. The epithelial cells of the dog's gall-bladder and bile ducts closely resemble those of the human specimens. (Figs. 1 and 2.) The parietal sacculi, discovered by Thiele and carefully studied by Beale, are small pouches extending from the bile ducts

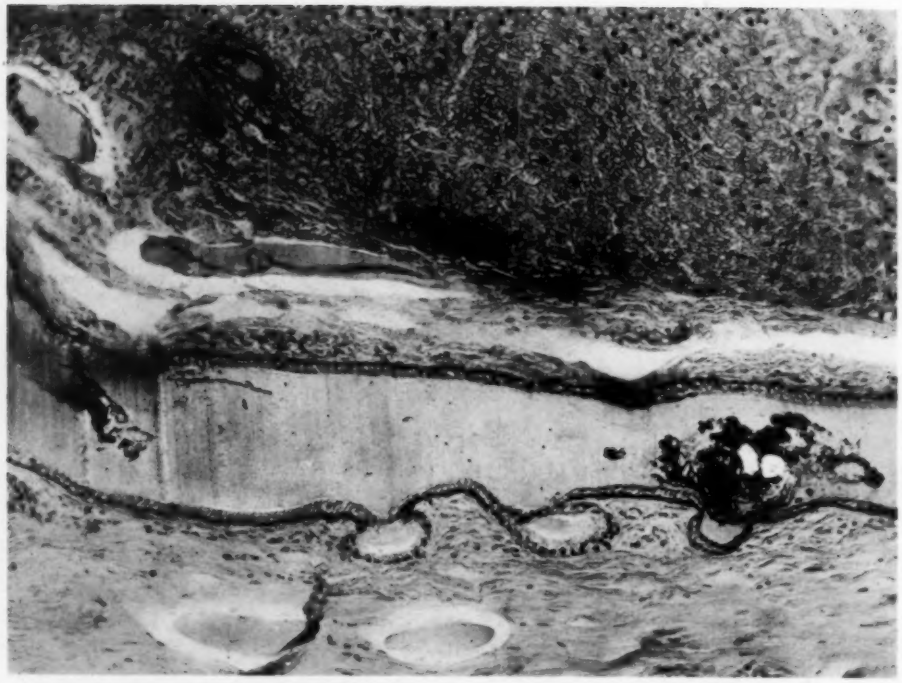

FIG. 2.—Normal intrahepatic bile duct of a dog showing parietal sacculi. Note the regular arrangement of the low columar epithelial cells.

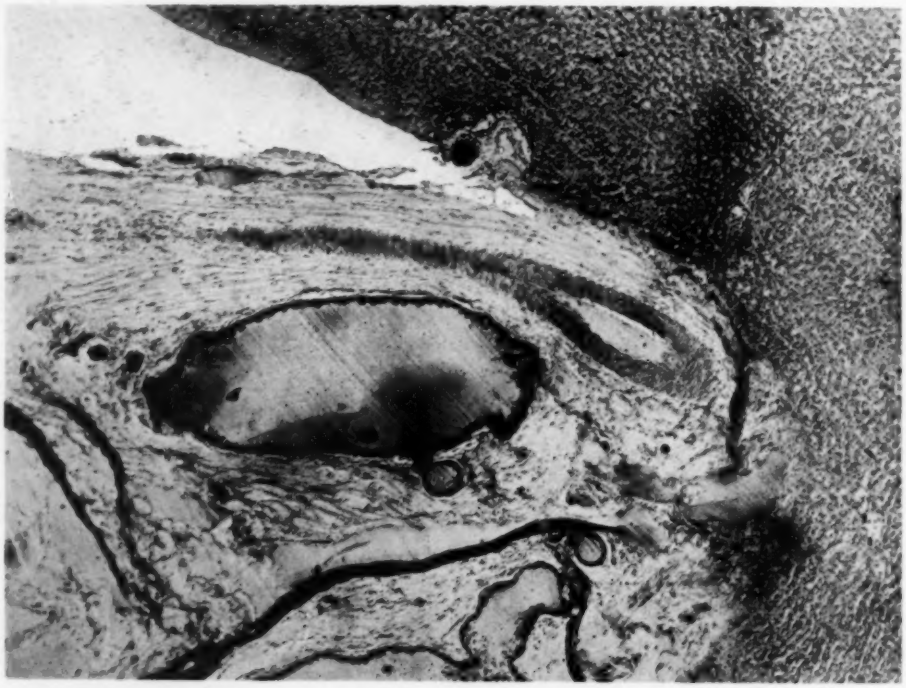

FIG. 3.—Intrahepatic bile duct of a dog fifteen days following cholecystectomy. Note the irregular surface of the duct epithelium with projecting cells and nuclei.

into their fibrous walls and the epithelial lining of these sacculi is continuous with and similar to that of the ducts themselves. (Fig. 2.)

Higgins in a study of the biliary tract of certain rodents, with and without a gall-bladder, chose the mouse, with a gall-bladder, and the rat which shows no vestige of a gall-bladder either in fœtal or adult life. The results of this work indicated that the only points of difference between the biliary tracts of these animals, other than that of size, are the presence of the gall-bladder in the mouse and the existence of an extensive branching hepatic plexus around the branches of the portal vein in the rat. This plexus may be an intrahepatic compensating mechanism for the concentration of the bile or

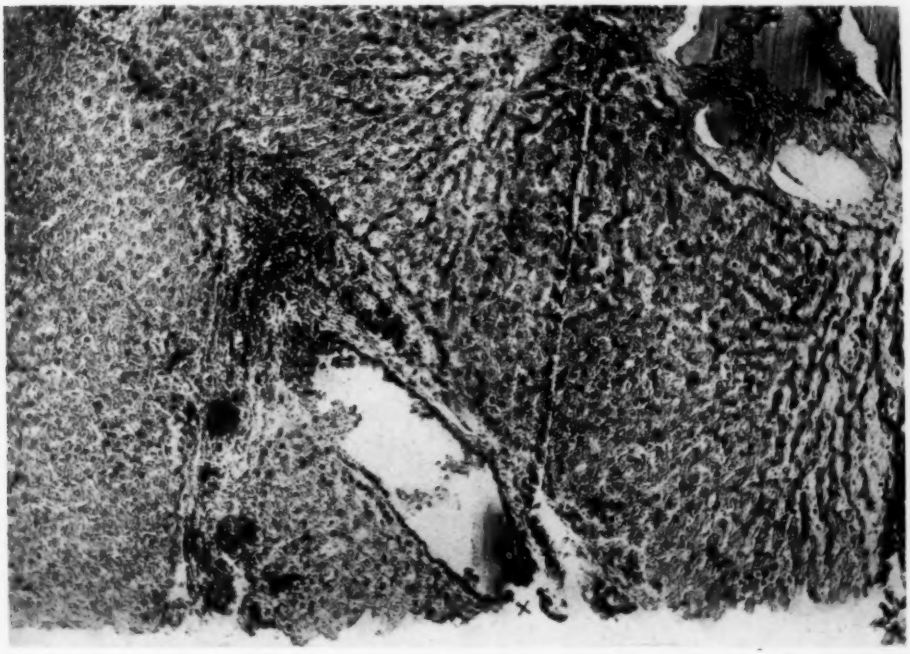

FIG. 4.—Intrahepatic bile duct of a dog fifteen days following cholecystectomy. Note the cords of cells projecting into the lumen.

for other functions analagous to those of the gall-bladder of the mouse. The bile from the hepatic duct of the rat averages, according to McMaster, eight times as much pigment as the liver bile of the mouse.

Definite changes in the extrahepatic bile ducts have been known to occur following cholecystectomy for the past decade. Judd and Mann, in 1917, observed dilatation of all of the ducts outside of the liver after the removal of the gall-bladder and concluded that this enlargement depends upon the competency of the sphincter of Oddi. Mann and Bollman studied the development of jaundice in dogs with common duct obstruction, before and following cholecystectomy. In those animals possessing an intact gall-bladder, bilirubin was found in the blood plasma twenty-four hours after the obstruction; but frequently a definitely positive test was not obtained earlier than thirty-

six hours after operation. Following cholecystectomy common duct obstruction resulted in faintly positive bilirubin tests as early as three hours and in from six to eight hours there was always a positive reaction. Sweet has shown that the total blood cholesterol rises very noticeably after the removal of the gall-bladder; reaching a point almost double the normal and then falling gradually until the curve approaches the normal level forty days after operation. A second noticeable fact is that the peak of the blood cholesterol rise following fat ingestion occurs normally at the sixth hour, whereas after the removal of the gall-bladder the highest point of the curve is reached at the ninth hour. In the dog, without the use of microscopic sections, Sweet

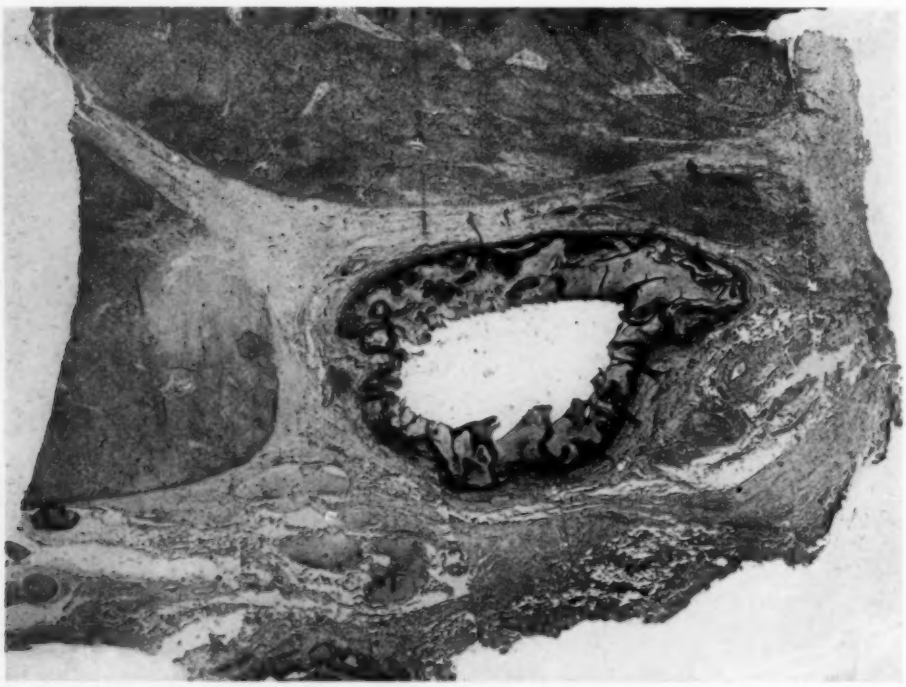

FIG. 5.—Intrahepatic bile duct of a dog forty days following cholecystectomy. Note the folds and villous-like projections extending from the wall into the lumen. These projections are surrounded by the gelatin injection mass; the central clear space indicates solution or loss of a portion of the gelatin during preparation of the section.

has also observed a most elaborate development of the parietal sacculi following cholecystectomy, as compared with their appearance before operation. All of these observations point to a readjustment, probably functional, of the duct system of the liver following the removal of the gall-bladder.

A study of the intrahepatic bile ducts is most satisfactory following injection of the system; and the injection mass must be smooth, homogeneous, and easy to handle. A solution of gelatin fulfills all of these requirements and possesses the added advantage of not melting when fixed in formalin. A colored mass is of great use and gelatin lends itself readily to treatment. Since gelatin is a colloid it is an amphoteric electrolyte and exists in three states according to its hydrogen ion concentration, namely as (*a*) an isoelec-

tric protein, (*b*) metal proteinate, and (*c*) protein acid salt. The isoelectric point of gelatin is, according to Loeb, pH 4.7; and at a pH greater than 4.7 it can combine only with cations forming metal gelatinates, and at a pH less than 4.7 it can combine only with anions, forming gelatin acid salts. Ordinary commercial powdered gelatin has a pH of about 7 and when it is soaked in a silver nitrate solution it unites with the silver, forming silver gelatinate. This compound when exposed to light becomes brownish black while a solution turns to a golden brown color. The 12 per cent. silver gelatin solution used in this investigation may be prepared as follows: soak 120 grams of powdered gelatin in 100 c.c. of 1 per cent. silver nitrate (ice cold) for twenty-

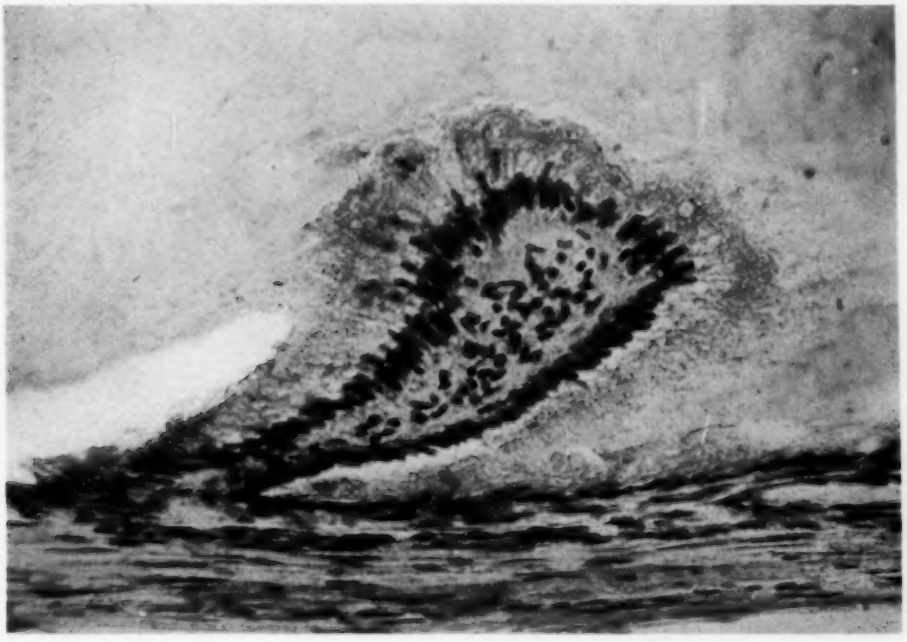

FIG. 6.—High power of a mucous fold projecting into a normal gall-bladder (from same specimen as Fig. 1).

four hours, wash on a filter with distilled water, melt the gelatin on a water bath and add sufficient distilled water to make 1000 c.c. Exposure to light results in a photochemical reaction which produces the colored solution and this silver gelatin, when melted, is a smooth homogeneous colloidal fluid which shows no precipitate or solid particles.

Perfectly fresh intact livers without tears or lacerations must be used and the injections made through the common bile duct. A large pressure bottle holding the melted silver gelatin is connected to a large mercury manometer with a large mercury well, leading to which is an air line connection. The mercury may be raised to any desired level by the compressed air and the injection can be accomplished by a steady, controlled, measured pressure. After filling the tube and cannula completely with the gelatin solution to exclude air, the cannula is introduced and tied into the common bile duct; and

the liver, cannula, tube and pressure bottle are submerged in warm water. Under a pressure of 100 to 180 millimetres of mercury the silver gelatin enters the biliary tract and penetrates to all parts. When the entire biliary system has become filled the liver is swollen, feels turgid and the surface is mottled; the gelatin shows through the capsule and many liver lobules are outlined. Maintaining the pressure, the liver is placed in ice cold 5 per cent. formalin which hardens and fixes the gelatin and preserves the specimen. Sections may be cut from any portion of the liver, embedded in paraffin and cut for microscopic study. The clearing fluids dissolve a certain amount of

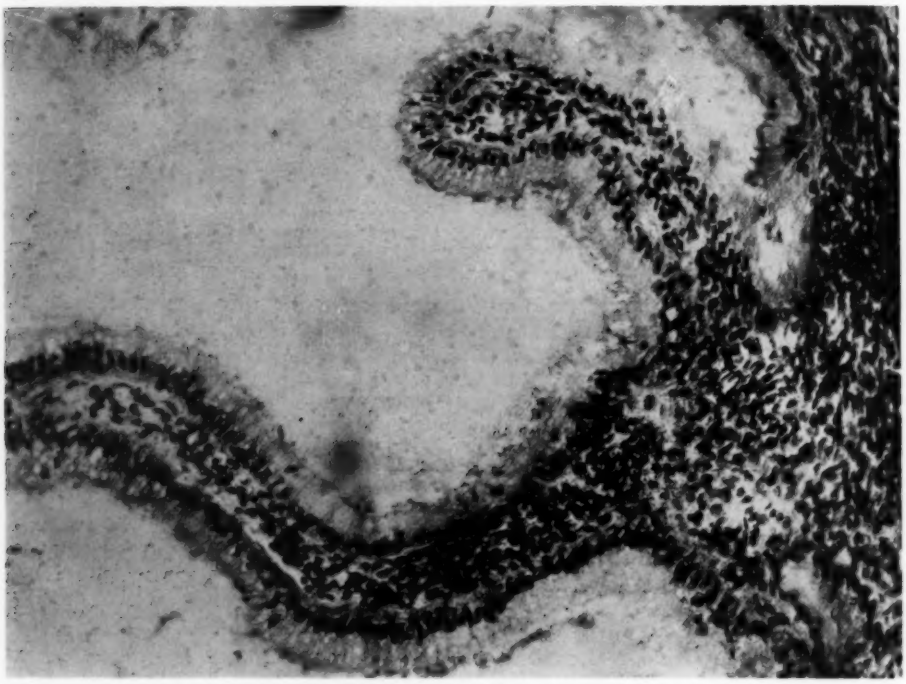

FIG. 7.—High power of mucous fold projecting into duct forty days after cholecystectomy. Compare with Fig. 6 from a normal gall-bladder.

the gelatin and in the cut sections the bile ducts are not all completely filled with the injection mass.

Simple cholecystectomy was performed in normal healthy dogs which were allowed to survive for variable lengths of time. No other operation, manipulation or treatments were performed. Normal healthy dogs upon which no operation had been done were used as controls. In each case the dogs were given lethal doses of ether and immediately following death the liver was removed intact with the diaphragm, stomach and duodenum; and injection of the biliary tract made through the common bile duct. The specimen was fixed in ice cold formalin; cubes of liver tissue cut from the interior of the organ near the porta hepatis were embedded in paraffin, cut and stained with hæmatoxylin and eosin.

Specimens were obtained and slides made from six normal dogs and from eighteen dogs following removal of the gall-bladder. All sections from the controls showed without exception a normal low columnar epithelium in the intrahepatic ducts. The sections taken following cholecystectomy presented curious pictures. Fifteen days following operation the epithelium shows areas of apparent disintegration, while in other regions there is a heaping up of the cells in multiple layers with cells containing large irregular nuclei. (Fig. 3.) The epithelial surface is irregular and in numerous sections presents a picture resembling bud formation. In many areas the cell margins

FIG. 8.—Parietal sarculi and small intrahepatic bile duct forty days after cholecystectomy.

can not be distinguished and their large nuclei appear to be projected into the lumen of the duct and in other regions exfoliation seems to have taken place. (Fig. 4.) These changes are found not only in the larger ducts but in the smaller as well. Forty days after operation these changes in the bile duct epithelium have progressed to such a degree that the picture is spectacular. Countless folds, projections and villous-like structures are found extending from the duct walls into the lumina. (Fig. 5.) The epithelium is high columnar with oval or fusiform nuclei, the long axes of which lie at right angles to the bases of the cells. A section of a mucous fold or villus presents a picture practically identical to that of a section of normal gall-bladder wall. (Figs. 6 and 7.) The parietal sacculi are enlarged and the epithelial lining has undergone the same change to high columnar epithelium although no folds or villi are present.

These striking changes lead to one conclusion: cholecystectomy deprives the dog of a useful organ and the closely related bile duct epithelium undergoes changes of adaptation to assume functions normally performed by the gall-bladder.

SUMMARY

1. Removal of the dog's gall-bladder produces striking changes in the epithelium of the intrahepatic bile ducts.

2. The low columnar epithelium is transformed into high columnar cells with folds and villi, covered with these cells, projecting into the lumen of the ducts.

3. The beginning of the change is demonstrable fifteen days after cholecystectomy; and at forty days after operation the changes are well advanced.

4. The picture presented by the duct epithelium forty days after the removal of the gall-bladder is that of an exaggeration of the folds projecting into a gall-bladder, and the epithelial cells and their arrangement resemble those of the normal gall-bladder to a remarkable degree.

5. The parietal sacculi enlarge following cholecystectomy and their epithelial cells undergo the same changes as those in the intrahepatic bile ducts.

6. No operation or manipulation other than simple cholecystectomy was performed on these dogs while they were living.

BIBLIOGRAPHY

Beale, L. S.: The Liver. J. & A. Churchill, London, pp. 48–49, 1889.

Counseller, V. S.: Certain Effects of Obstruction of the Bile Ducts. ANNALS OF SURGERY, vol. lxxxvii, pp. 210–230, 1928.

Higgins, G. M.: The Biliary Tract of Certain Rodents with and without a Gallbladder. Anat. Rec., vol. xxxii, pp. 89–111, 1926.

Judd, E. S., and Mann, F. C.: The Effect of the Removal of the Gall Bladder. Surg., Gynec., & Obst., vol. xxiv, pp. 437–442, 1917.

Loeb, Jacques: Proteins and the Theory of Colloidal Behavior. McGraw-Hill Book Company, Inc., New York, pp. 28–29, 1922.

Mann, F. C.: The Functions of the Gall Bladder. Phys. Rev., vol. iv, pp. 251-273, 1924.

Mann, F. C., and Bollman, J. L.: The Relation of the Gall Bladder to the Development of Jaundice Following Obstruction of the Common Bile Duct. Jour. Lab. & Clin. Med., vol. x, pp. 540–543, 1924–25.

McMaster, P. D.: Do Species Lacking a Gall Bladder Possess Its Functional Equivalent? Jour. Exp. Med., vol. xxxv, pp. 127–140, 1922.

McMurrich, J. P.: The Development of the Human Body. A Manual of Human Embryology. 4th Ed. P. Blakiston's Son & Company, Phila., pp. 306–309, 1914.

Piersol, G. A.: Normal Histology. J. B. Lippincott Company, Phila., pp. 181–183, 1910.

Sweet, J. E.: The Gall Bladder, Its Past, Present and Future. Internat. Clin., vol. i, series xxxiv, pp. 187–226, 1924.

OBSERVATIONS ON PEPTIC ULCER

VII. CLINICAL CORROBORATION OF EXPERIMENTAL DATA

By Charles Bruce Morton, M.D.

and

Joseph B. Graham, M.D.

of the University of Virginia

From the Departments of Surgery and Gynecology and of Pathology of the University of Virginia

One of the major problems in evaluating experimental data and establishing their clinical applicability is the difficulty of finding exactly parallel clinical and experimental conditions. This is particularly true in the investigation of peptic ulcer. In previous papers one of us (Morton) has described experiments in which the formation of typical chronic peptic ulcers was induced in the stomach and duodenum of dogs in a high percentage of experiments. The case of a recent patient at the University of Virginia Hospital seems to corroborate certain of the experimental data. The history is reported herewith and will be discussed from that standpoint.

Case Report.—The patient, a married white woman aged fifty-four years, was admitted to the Medical Service, University of Viriginia Hospital, April 1, 1929. The chief complaint was attacks of pain in the upper right quadrant of the abdomen during the past twenty years. For the first two years the attacks had been rather severe but subsequently had become milder and less frequent until five months prior to the time of admission. Since that time the attacks had occurred every two or three weeks. A typical attack had begun with a sense of fullness in the epigastrium and been followed in an hour or two by excruciating pain under the right costal border. The pain had radiated through to the right scapular region and lasted for from two to four hours. She had taken hot soda water and induced vomiting but without relief. Hypodermics had not been tried. The day following the acute pain she had felt feverish, sometimes had a slight chill and the upper right quadrant of the abdomen felt sore and tender. She said she had never been jaundiced but that for a day or two following an attack the stools had been light colored frequently. There had been no dark colored or bloody vomitus and no bloody or tarry stools.

Her family history and past history by systems were negative. She had had nine pregnancies and had nine children living, the youngest aged twelve years.

Examination.—The woman was rather obese, her weight 185 pounds, her height 5 feet 1 inch. The temperature, pulse and respirations were normal. The systolic blood pressure was 152 and the diastolic 85. The sclera were clear; all teeth except two lower molars had been extracted. The heart and lungs were normal. The abdomen was obese and there was some tenderness with muscle spasm in the upper right quadrant. The pelvis, extremities and reflexes were normal. The hæmoglobin was 45 per cent.; erythrocytes 4,570,000 and leucocytes 5,000 in each cubic millimetre. A catheterized specimen of urine revealed occasional hyaline casts. The urine contained no urobilin, urobilinogen or bile. The Wassermann reaction was negative; the clotting time 6 minutes; bleeding time 2 minutes and the icterus index 10.4. The Van den Bergh, both direct and indirect reactions, was negative. Examination of the stool revealed nothing abnormal. A test meal was given, 17 cubic centimetres withdrawn and found to contain free hydrochloric acid 30° and total acids 49°. Cholecystographic studies revealed a non-functioning gall-bladder with probable cholelithiasis.

The diagnosis of cholecystitis with probable cholelithiasis was made and operation advised. She was transferred to the Surgical Service April 10, 1929.

Operation.—On April 11, 1929, under ether anæsthesia the abdomen was explored through an upper right rectus incision. The liver was small and somewhat scarred. The region of the gall-bladder was a mass of adhesions. The stomach, pylorus and duodenum were normal. The pancreas seemed normal. The uterus was small and the ovaries were atrophied. The appendix showed evidence of former disease and was removed.

The gall-bladder was small and fibrous, contained several stones and its fundus was adherent to the common bile duct which was dilated to about 2.5 centimetres in diameter and contained several stones. The duct was incised and five facetted stones, each about 1 centimetre in diameter, were removed from it. A lead probe was passed through the common duct for some distance up to the hepatic ducts and down into the duodenum without encountering evidence of any other calculi. The gall-bladder was removed from above downward. A small anomalous duct about 1 millimetre in diameter was found entering the fundic third of the gall-bladder directly from the adjacent liver. This duct and the cystic duct and artery were doubly clamped, sectioned and ligated. A Mayo-Robson tube was anchored in the common duct, a cigarette drain placed in the gall-bladder notch of the liver and the abdomen closed in the usual manner.

Pathologic Report.—Chronic appendicitis; marked sub-acute and chronic cholecystitis with multiple stones in the gall-bladder and common bile duct.

Post-operative Course.—An intravenous infusion of a 5 per cent. solution of glucose was administered immediately after operation. Sips of water were given on the following day and in addition two intravenous infusions, one of saline and one of glucose solution. Proctoclysis was employed for three days after operation. The day after operation the patient's highest temperature was 102°. It subsided rapidly and remained normal and subnormal after the fourth day. A soft diet was allowed on the sixth day and the patient seemed to be in normally good condition except for poor appetite and overanxiety. During this period drainage of bile from the tube in the common bile duct had been progressively less profuse with only slight to moderate leakage of bile by the side of the tube. The stools were normal and the leucocytes numbered 11,000 in each cubic millimetre.

On the tenth day the Mayo-Robson tube came free and was removed. For a few hours bile drained from the wound rather freely and then ceased entirely for twenty-four hours. At the end of that time it recommenced and continued rather freely throughout the remainder of the patient's illness. Food became more and more distasteful to her and it was difficult to induce her to eat anything. She was very pessimistic and overanxious.

On the nineteenth day she became nauseated, began to vomit small amounts frequently and complained of some pain in the upper abdomen. The wound looked healthy and the temperature was normal but the leucocytes numbered 17,000. The stools were light colored and contained no bile. An intravenous infusion of glucose solution was given and the stomach lavaged on the following day. The washings contained some brownish particles of old blood. Another intravenous infusion of glucose solution was given.

On the twenty-first day after operation medical consultants found that the blood pressure was low (systolic 92, diastolic 72) and the heart sounds and pulse weak. Thyroid extract, gr. ½, B.i.d. was ordered. On this day three intravenous infusions were given, one of glucose and two of saline solution. Vomiting continued, however, and the vomitus was dark brown in color. Titration of the material showed free hydrochloric acid 46° and total acids 67°. The benzidine test for blood was positive.

For the next two days nothing was given by mouth and proctoclysis and intravenous infusions of glucose and saline were employed. The patient's condition improved very much, no more vomiting occurred and she said that she felt better than at any previous

time since operation. Bile continued to drain freely from the incision, however, at the point where the tube had been.

Small amounts of fluid by mouth were allowed on the twenty-fourth day. At about 5:30 P.M. the patient felt suddenly weak and when seen the skin was clammy and pale, the pulse very weak and the respiration labored. An intravenous infusion was commenced but in spite of it and various other stimulative measures the patient died after a few minutes.

Post-mortem Examination.—(May 5, 1929.) At necropsy the outstanding findings were as follows: The skin and sclera showed no evidence of jaundice. The general peritoneal cavity was clean and free except for numerous adhesions about the site of the cholecystectomy. The ligated stump of the cystic duct was intact. The common bile duct was dilated to about 2 centimetres in diameter and contained a small fistulous

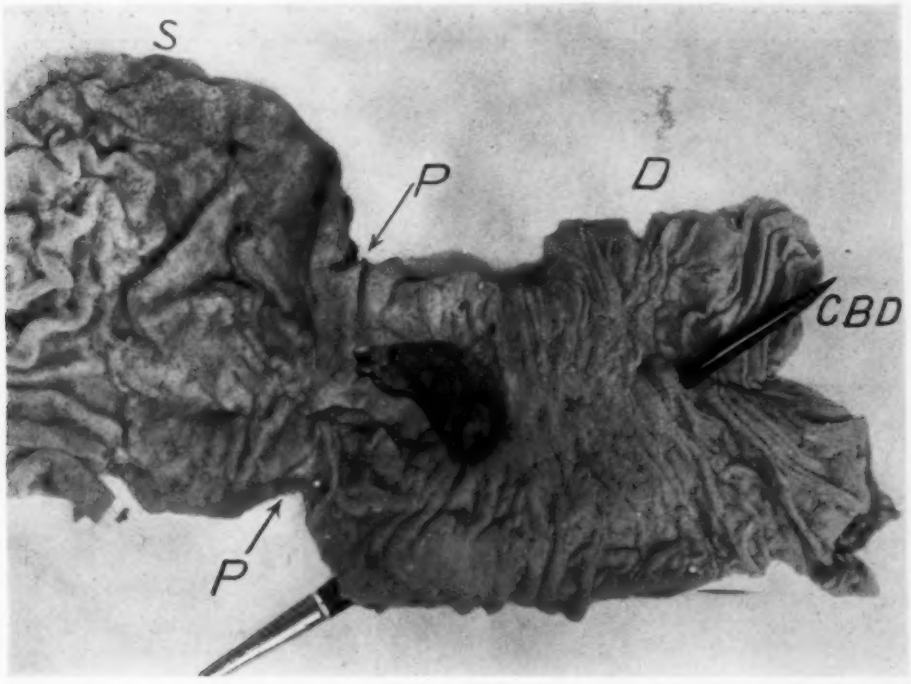

FIG. 1.—Part of the stomach and duodenum showing the large duodenal ulcer and its relation to the papilla of Vater and the pylorus.

opening which communicated with the sinus in the abdominal wall. There was a facetted gall-stone, 1 centimetre in diameter, impacted in the distal portion of the common duct about 2 centimetres proximal to the ampulla of Vater. It apparently caused complete obstruction of the duct. There was a pancreatic stone 0.5 centimetre in diameter, impacted in the distal portion of the main pancreatic duct and about 1.5 centimetres proximal to the ampulla of Vater.

The duodenum was intimately adherent to the head of the pancreas which was moderately indurated in that region. *In the duodenum immediately overlying this area there was a large ulcer which had eroded through the entire thickness of the duodenum so that the base of the ulcer was formed by the pancreas* (Fig. 1). This ulcer was 3.5x2 centimetres in dimension with its long axis parallel to that of the duodenum. It was 7 millimetres in depth and the edges were slightly overhanging. In the base was some dark blood clot. Directly opposite this ulcer and slightly distal to it was a smaller superficial erosion 5x5 millimetres in dimension.

The gastric mucosa showed some congestion and was covered in places with mucus. The entire intestinal tract contained large quantities of dark clotted and decomposed blood. The immediate cause of death was taken to be the severe hæmorrhage from the large duodenal ulcer. The other abdominal and thoracic viscera did not reveal anything of importance. Microscopically the duodenal ulcers were acute and subacute types. The pancreas showed fibrosis and lymphocytic infiltration.

Discussion.—In the case just described a succession of circumstances produced changes in the physiologic processes of the gastro-intestinal tract which closely paralleled those induced by certain previously reported experiments on dogs.

Early experiments were reported by Mann and Williamson who transplanted the common bile duct and pancreatic ducts to the lower intestine.

FIG. 2.—An experimentally produced ulcer in a dog.

Following these procedures typical chronic peptic ulcers developed in the duodenum in more than 90 per cent. of experiments. It was found that the same result might be accomplished by surgical duodenal drainage and one of us (Morton) has already reported several series of experiments with this operative procedure.

The operation for establishing surgical duodenal drainage was performed as follows: The pylorus and duodeno-jejunal junction were severed and both of the cut ends of the duodenum closed by suture. The pyloric end of the stomach and the open end of the jejunum were next joined by end-to-end anastomosis. The continuity of the gastro-intestinal tract was thereby re-established. The closed segment of duodenum was then drained into the lower intestinal tract by side-to-side anastomosis with the ileum.

The results of the experiments were striking in that peptic ulcers developed in the jejunum in 100 per cent. of twenty consecutive experiments. The ulcers were typical subacute and chronic lesions and were grossly and microscopically almost indistinguishable from peptic ulcers found in the duodenum of man. They occurred just distal to the pylorus at the point where the acid chyme emptying from the stomach impinged directly against the wall of the intestine (Fig. 2).

In the clinical case the following succession of events apparently took place: Attacks of cholecystitis, which first appeared twenty years before the time of her admission to the hospital, were followed by the formation of gall-stones, six of which remained in the common duct. But there could not have been very great obstruction to the flow of bile through the duct, for the patient was not jaundiced at any time. That there was some chronic biliary obstruction, however, is evidenced by the icteric index which was 10.4.

A pancreatic stone apparently formed in the main pancreatic duct some time prior to the patient's entry into the hospital, but its presence was not recognized either before or at the time of operation. Some chronic obstruction to the flow of pancreatic juice, however, must have been present.

At the operation a very badly diseased gall-bladder was excised and five stones removed from the common duct. The sixth stone was not found and must have been pushed up into the hepatic duct system and held there by the Mayo-Robson tube which was placed in the common duct. When the tube was removed the stone was allowed to slip down into the common duct distal to the choledochostomy opening. That it did not cause immediate complete obstruction to the lumen of the common duct is evidenced by the fact that no drainage of bile from the incision occurred for a period of twenty-four hours. Complete obstruction must have occurred on the twelfth day after operation, because the profuse flow of bile from the incision and the absence of bile from the stools commenced on that day.

There was nothing in the patient's history to suggest the presence of a gastric or duodenal ulcer and no palpable or visible evidence of one was found at the time of operation. On the nineteenth day after operation, however, she complained of some epigastric pain and nausea and vomiting commenced. Washings from the stomach and the stools contained old blood. At necropsy a large duodenal ulcer and evidence of severe hæmorrhage from it were found. It is impossible to state the exact time at which the ulcer originated. A small ulceration overlying the head of the pancreas might have been missed at the time of operation but, granting such a possibility, the subsequent erosion of tissue must have been very rapid to have made possible the formation of the large and deep ulcer crater which was found at necropsy.

The close parallel between the conditions bearing on the formation of the clinical and the experimental ulcerations is obvious. In the experiments the formation of chronic peptic ulcers followed surgical duodenal drainage which prevented the discharge of the alkaline pancreatic juice and bile into

the pyloric portion of the intestine. The ulceration occurred just distal to the pylorus.

In the clinical case the ulcer probably formed and certainly progressed rapidly following interference with the discharge of bile and pancreatic juice into the duodenum. Pancreatic juice could hardly have been discharged freely past the stone in the pancreatic duct and bile must surely have been completely excluded from the duodenum by the impacted stone in the common duct. As in the case of the experimental ulcers this ulcer occurred just distal to the pylorus. Gross and microscopic examination of the two types, experimental and clinical, revealed identical characteristics.

Because of the similarity in location, structure and other characteristics of the ulcers and because of the close parallel between the changed physiologic processes in each instance it seems reasonable to suggest that the findings in the case reported present corroborative evidence in favor of the applicability of certain previously reported experimental data to the clinical problem of the ætiology of peptic ulcer.

SUMMARY

The difficulty of evaluating and establishing the clinical applicability of experimental data was mentioned. A case was reported, the history of which had led to an operation for cholecystic disease. The appendix and gall-bladder were excised, multiple stones removed from the common bile duct and choledochostomy performed. There was no palpable or visible evidence of ulceration of the stomach or duodenum at that time. The patient died twenty-four days after operation of an acute hæmorrhage from a large duodenal ulcer which was discovered at necropsy. An additional gall-stone was found to have obstructed the lumen of the common bile duct completely and a pancreatic stone was partially obstructing the main pancreatic duct. The formation of the ulcer was attributed to the interference with the discharge of alkaline pancreatic juice and bile into the duodenum. Attention was called to the formation of identically similar ulcers in dogs following surgical duodenal drainage, an experimental procedure which diverts the pancreatic juice and bile from the region of the pylorus. It was suggested that the findings in the case reported presented corroborative evidence in favor of the applicability of one of the authors' (Morton's) previously reported experimental data to the clinical problem of the ætiology of peptic ulcer.

BIBLIOGRAPHY

Mann, F. C., and Williamson, C. S.: The Experimental Production of Peptic Ulcer. ANNALS OF SURGERY, vol. lxxvii, pp. 409–422, 1923.

Morton, C. B.: Observations on Peptic Ulcer. V. Findings in Experimentally Produced Peptic Ulcer: Etiologic and Therapeutic Considerations. ANNALS OF SURGERY, vol. lxxxvii, pp. 401–422, 1928.

TUBERCULOSIS OF THE SIGMOID COLON SIMULATING A PRIMARY MALIGNANT LESION*

By J. Arnold Bargen, M.D., Murray M. Copeland, M.D.
and
Fred W. Rankin, M.D.
of Rochester, Minnesota
from the Mayo Clinic

Primary ulcerative lesions of the colon are rarely tuberculous. The frequency with which such lesions are mistaken for tuberculosis is best illustrated by the fact that many patients with chronic ulcerative colitis examined at The Mayo Clinic previously have received diagnoses of tuberculosis of the colon. Only an occasional case justifies such confusion, for usually tuberculous ulcerative colitis presents a picture vastly different from that of chronic ulcerative colitis, both from the proctoscopic and the röntgenologic standpoints. Tuberculous ulcerative colitis is usually secondary to pulmonary or other primary tuberculosis. Acid-fast bacilli in the stools do not necessarily connote the existence of intestinal tuberculosis. Thus, Brown and Sampson found the sputum free from acid-fast bacilli in only 9 per cent. of 277 patients with pulmonary tuberculosis who also had intestinal lesions. Again, Nüssel in 120 patients with pulmonary tuberculosis of whom only six had intestinal tuberculosis, found acid-fast bacilli in the stools of 110 (91 per cent.); or, the stools of only 9 per cent. were free. Klose, in sixty cases in which acid-fast bacilli were found in the sputum, found the bacilli in the feces of fifty-five; in only six of these cases was there a suggestion of intestinal tuberculosis.

Clinically, a primary lesion may not always be found even in cases of ulcerative tuberculosis of the colon. There is a hyperplastic type of tuberculosis which may be primary in the colon. This occurs most frequently in the cæcum or ileocæcal coil of the intestine and the frequency of its occurrence decreases in direct ratio to its distance from the cæcum; hence the hyperplastic type of rectal tuberculosis is probably the rarest of all forms of tuberculosis. One of us (Bargen) has reported such a case.

In 100 cases of tuberculosis of the colon, reviewed by Lockhart-Mummery, six were of the sigmoid portion, and one was of the rectum. In records of 22,725 necropsies reviewed by Gant, an incidence of primary tuberculosis of the colon was noted in 7.22 per cent., emphasizing further the infrequent occurrence of this disease in the colon.

Mailer, in 1927, emphasized the paucity of the occurrence of hyperplastic tuberculosis of the colon in general and, in particular, the infrequency of the coexistence of tuberculosis of the sigmoid and other lesions. He stressed the difficulties in diagnosis and emphasized the importance of diagnosis to express prognosis.

* Submitted for publication August 14, 1929.

Carman, in his book on "Röntgen diagnosis of diseases of the alimentary canal," did not present a röntgenogram of a tuberculous sigmoid colon, and such a specimen of tuberculosis of the sigmoid colon is not filed in the museum of the Royal College of Surgeons.

W. J. Mayo as early as 1899 stressed the infrequent occurrence of tuberculous lesions of the sigmoid colon when he, in a report of seven cases of tuberculosis of the colon, noted two in this region. Again, in 1909, he called attention to the rarity of tuberculosis of the sigmoid colon in comparison to that in the cæcum.

Brown and Sampson, in 1926, called attention to the fact that stenosis of the colon occurred more commonly in primary than in secondary intestinal tuberculosis.

A further interesting observation has been made by Yeomans, that tuberculous ulcers of the sigmoid colon encircle the bowel, following the course of the blood vessels, as in the ileum. This might explain the similarity of the filling defect as detected by Röntgen ray, in certain malignant and tuberculous lesions. Tuberculous peritonitis with tuberculous colitis occurs occasionally. Lemon noted only ten cases of tuberculous peritonitis in a series of fifty cases of ulcerative tuberculosis of the colon. It is a well-known fact that in the hyperplastic type of intestinal tuberculosis the incidence of peritonitis is much smaller than in other forms of the disease.

The rare occurrence of tuberculosis of the sigmoid colon, the infrequency of tuberculous peritonitis with tuberculosis of the colon, its close similarity to other obstructive lesions of the colon, and the difficulties encountered in its diagnosis, led us to report the following cases. The possibility of there being two lesions is fully appreciated, but the ease of explaining symptoms and visible pathologic evidence on the basis of one lesion suggested careful consideration of tuberculosis in similar cases in the future.

Case Reports.—Case I.—A woman, aged fifty-nine years, a housewife, was admitted to The Mayo Clinic April 9, 1929, complaining of "bowel trouble." As a girl of six years a short attack of indeterminate jaundice had developed but there had been no further recurrence. A pterygium had been removed from the left eye when the patient was thirty-nine years old. For many years she had suffered from mild constipation, which gradually had increased until she had used cathartics occasionally for relief. For the two years before she came to the clinic she had noticed considerable flatulence and eructation. In September, 1928, there had been an increase in constipation, with some postprandial bloating, and her appetite had become poor. In December great difficulty in evacuation of the bowels had been experienced, although much castor oil had been administered by mouth. The stools had become small and somewhat "pencil-shaped." In February, 1929, she had begun to pass mucus in the stools, and although she had suffered from hemorrhoids for several years, with occasional streaking of stools with blood, blood had not been noted admixed with stools until one month before admission to the clinic. Two weeks before admission, diarrhœa had developed, and many of the stools had been admixed with mucus and blood. Straining at stool had caused passage of considerable blood. A point to be stressed is the fact that the diarrhœa had persisted at night. Slight fever had occurred from time to time, with intermittent periods of obstipation, and subsequent stools had been foul in odor. For a few months prior to admission the patient had experienced some tachycardia and dyspnœa when bloating had

occurred. Urinary symptoms had been practically absent. During her illness and for three weeks prior to admission symptoms had been relieved considerably by the constant taking of medicated oils.

The patient was markedly emaciated and sallow. The mucous membranes were pale. The tonsillar beds were somewhat scarred. Many teeth had been removed and those which remained were carious. Examination of the thorax revealed some emphysema of the lungs. The heart was slightly enlarged, with a systolic murmur at the apex replacing the first heart sound. The abdomen was distended and tympanitic, with generalized rigidity which made examination of the viscera impossible. Nevertheless, a peculiar doughy feel was imparted to the palpating hand. The abdomen was not especially tender. Hemorrhoids and an anal fissure were found on rectal examination. Pelvic examination disclosed a lacerated cervix. The uterine adnexa were not felt. Röntgenograms of the thorax showed evidence of pleuritic thickening at the base of the right lung and extending upward to the level of the fourth rib; also there were adhesions to the diaphragm. It was suggested by the röntgenologist that this might be metastatic pleural involvement. A röntgenogram of the colon, after belladonna had been administered, disclosed a filling defect in the middle portion of the sigmoid colon. The röntgenologic diagnosis was carcinoma. (Fig. 1.) The proctologist noted that he could not view the sigmoid due to sharp angulation, that the hemorrhoids and the anal fissure might account for the bleeding, but that he felt that there was some pathologic condition above the point seen because the motion of the bowel was not as free as usual. The hemoglobin was estimated at 74 per cent. (Dare); erythrocytes numbered 5,000,000 and leukocytes 14,300 for each cubic millimetre. Albumin in the urine was graded 1+ and the urine contained an occasional erythrocyte and a few leukocytes. The Wassermann reaction of the blood was negative.

FIG. 1.—A filling defect in the middle portion of the sigmoid colon.

The patient was admitted to the hospital with a diagnosis of malignant lesion of the sigmoid colon, and, following proper pre-operative treatment, exploration was done April 25, 1929. An incision was made low in the middle line and the operator exposed a very markedly thickened peritoneum. This was opened, and numerous coils of intestine were found adherent to each other and studded with tubercles. The general cavity was not subjected to exploration but it was assumed that the lesion was one of generalized abdominal tuberculosis. The operation was limited to abdominal exploration.

Since the operation, the patient's progress has been uneventful and the prognosis so far seems hopeful.

CASE II.—A man, aged forty-four years, a freight clerk, was admitted to The Mayo Clinic March 19, 1929, complaining of "stomach trouble." The present illness had begun in June, 1928, with an uncomfortable feeling in the upper left part of the abdomen on bending the body. Pain had not been experienced at this time. The patient had visited a physician and had been given a modified Sippy diet for three weeks. At the end of this time the patient's weight had dwindled thirty pounds. Feeling that this diet was

of little benefit, he had reverted to a normal diet and had felt very well until December, 1928. At this time, he had begun to notice mild postprandial epigastric pain. He had sought naturopathic treatment; this had been followed by increase in epigastric distress and the further loss of twenty-five pounds in weight. The epigastric pain had followed meals immediately and had been of a burning character. Sometimes a stinging pain had radiated to the left shoulder, and had lasted only a few minutes. The abdominal pain gradually had diminished until the next meal. Since December, 1927, the patient had been suffering from constipation, with intermittent exacerbations of difficulty in movements of the bowel. In January, 1929, griping pains in the lower part of the abdomen had developed; these had been relieved by evacuation of the bowel. For one week before admission to the clinic he had taken a cathartic twice daily, with the result that distress in the epigastrium and in the lower part of the abdomen had become much less. There had not been any blood in the stools. In spite of a good appetite during the course of his illness, from one to two pounds of weight had been lost weekly, and within ten months fifty-seven pounds had been lost. In January and part of February the patient had experienced pain in the region of the bladder when it had been full, and a sharp pain in the end of the penis on urinating.

FIG. 2.—A filling defect of the distal part of the sigmoid colon.

The patient showed evidence of marked loss of subcutaneous fat, and the mucous membranes were pale. There was an old scar on the right cornea. The pharynx was hyperæmic. The chest seemed normal on auscultation and percussion. The abdomen was rigid, and not especially tender, but nothing could be made out concerning the viscera because of the rigidity. The doughy sensation was even more marked in this case. The genitalia were normal; rectal examination did not reveal anything of note. Röntgenograms of the thorax gave negative evidence. Röntgenograms of the colon, after belladonna had been given, showed a filling defect of the distal part of the sigmoid colon that was said to be caused by carcinoma. (Fig. 2.) Proctoscopic examination revealed internal and external hemorrhoids. The urine was negative to examination. Hemoglobin was estimated at 54 per cent. (Dare) erythrocytes numbered 4,120,000 and leucocytes 5200 for each cubic millimetre. Chemical examination of the blood gave negative results. After a test-meal, examination of gastric content disclosed total acidity of 44 and free hydrochloric acid of 30 in terms of cubic centimetres of tenth-normal sodium hydroxide. The Wassermann reaction of the blood was negative.

The patient was admitted to the hospital with a diagnosis of malignant lesion of the sigmoid colon. Following adequate pre-operative preparation, abdominal exploration was performed under general anæsthesia March 29, 1929. A low left rectus incision was made, and a typical condition of tuberculous peritonitis was found; the peritoneum was thickened and studded with tubercles. All of the coils of the intestine, and the omentum which lay in the vicinity of the opening, were adherent to each other and to the abdominal wall; these viscera also were studded with tubercles. A specimen removed for diagnosis showed the condition to be due to tuberculosis. Because of free

bleeding, an attempt was not made to examine the sigmoid colon and the wound was closed without further exploration.

Except for four days following operation, the patient's temperature was practically normal. There was a flare-up of the old corneal scar, with mild iritis, but this was well under control. The incision healed without difficulty and the patient was dismissed from the hospital and clinic with his condition noted as satisfactory. A recent follow-up inquiry has elicited the information that he is distinctly weak and is again suffering from abdominal cramps.

Comment.—Tuberculous lesions of the colon, as a primary disease, have been reported. When they occur, their common site is the ileocecal region. Tuberculosis of the sigmoid colon is one of the rare forms of tuberculosis of the colon. Definite proof does not exist that the primary lesion in these two cases was in the sigmoid colon but several observations suggest this. The surgeons who performed exploration in these cases noted that the greater bulk of the lesion was in the left lower part of the abdomen. Obstruction occurred in the sigmoid colon. The absence or scantiness of the bleeding in the presence of a large obstructive lesion argues against the presence of a malignant condition. Rankin and Yeomans previously have noted the similarity of the röntgenographic defects produced by tuberculous and malignant lesions. The absence of tuberculous lesions elsewhere than in the sigmoid colon is noteworthy. With these facts in mind, it would seem hardly necessary to search for two types of lesions, that is, for both a malignant and a tuberculous condition, to explain the pathologic data.

Pincoffs and Boggs noted that in tuberculosis of intra-abdominal origin, masses of tuberculous nodules will occur in various places, and that there is more matting of viscera than with tuberculosis of distant origin. The conditions indicative of intra-abdominal origin of the process obtained in both of the cases reported in this paper.

Bloodgood called attention to the significance of leucocytosis in the diagnosis of obstruction with tuberculosis, and he has further emphasized the unfavorable prognosis in most such cases.

The absence of lesions in the rectum and in the rectosigmoid portion of the colon, as noted by proctoscopic examination, argues against the presence of an ulcerative type of lesion, and further, the absence of deformity or of any defect of the colon elsewhere is evidence against the presence of tuberculosis of the proximal portion of the colon and in favor of the disease being of the hyperplastic type.

The peculiar feel of the abdominal wall, as imparted to the palpating hand, in both of these cases, and the associated tuberculous peritonitis, are most significant.

The suggestion is, then, that we may be dealing here with primary tuberculosis of the sigmoid colon, and with tuberculous peritonitis. An effort has been made to set forth some of the diagnostic data.

BIBLIOGRAPHY

[1] Bargen, J. A.: Tuberculosis of the Rectum. Proc. Staff Meetings Mayo Clinic, 1926, vol. i, p. 205.

[2] Bloodgood, J. C.: Quoted by Hamman, L.: The Statistics of Tuberculous Peritonitis, from the Clinical Records of the Johns Hopkins Hospital. Johns Hopkins Hosp. Bull., vol. xix, pp. 256-259. 1908.

[3] Brown, L., and Sampson, H. L.: Intestinal Tuberculosis. Philadelphia, Lea and Febiger, p. 223, 1926.

[4] Carman, R. D.: The Röntgen Diagnosis of Diseases of the Alimentary Canal. Philadelphia, W. B. Saunders Co., 676 pp., 1920.

[5] Gant, S. G.: Diseases of Rectum, Anus and Colon. Philadelphia, W. B. Saunders Co., vol. iii, 528 pp., 1923.

[6] Klose, F.: Ist der Nachweis von Tuberkelbazillen im Stuhl von Phthisikern für die Diagnose Darmtuberkulose verwertbar? Münch. med. Wchnschr., vol. lvii, pp. 133-134, 1910.

[7] Lemon, W. S.: Tuberculous Enterocolitis. Minn. Med., vol. vi, pp. 572-578, 1923.

[8] Lockhart-Mummery, P.: Diseases of the Rectum and Colon and Their Surgical Treatment. New York, William Wood and Co., 872 pp., 1923.

[9] Mailer, R.: Diverticulitis of the Sigmoid Associated with Tuberculosis: Report of Two Cases. Am. Jour. Surg., vol. ii, pp. 142-146, 1927.

[10] Mayo, C. H.: Tuberculous Peritonitis. Minn. Med., vol. iv, pp. 259-264, 1921.

[11] Mayo, W. J.: Localized Tuberculosis of the Intestine. New York Med. Jour., vol. lxx. pp. 253-258, 1899.

[12] Mayo, W. J.: Tumors of the Sigmoid. Montreal Med. Jour., vol. xxxviii, pp. 645-653. 1909.

[13] Nüssel, Kurt: Tubercle Bacilli in Feces. Münch. med. Wchnschr., vol. lxx, pp. 357-358, 1923.

[14] Pincoffs, M. C., and Boggs, T. R.: Diseases of the Peritoneum. Oxford Medicine, vol. iii, part ii, pp. 550-566, 1920.

[15] Rankin, F. W.: Surgery of the Colon. New York, D. Appleton and Co., p. 260, 1926.

[16] Yeomans, F. C.: Proctology. A treatise on the malformations, injuries and diseases of the Rectum, Anus and Pelvic Colon. New York, D. Appleton and Co., p. 334, 1929.

THE SURGICAL MANAGEMENT OF STONE IN THE URETER

By John B. Deaver, M.D. and Verne G. Burden, M.D.
of Philadelphia, Pa.

In the conduct of a large surgical practice many cases of urologic disease are encountered and the coöperative efforts of the surgeon, urologist and röntgenologist are essential for diagnosis and therapeutic management. The exactness of the methods of urologic diagnosis is exceeded only by the revelations of the aseptic scalpel. While the surgeon's hand will be guided by the data obtained by the use of the cystoscope and X-ray, his procedure must be counseled by sound judgment when the actual disease is exposed.

Obstruction in the drainage channels of the body is always a serious matter and relief is frequently an urgent question of life or death. Obstruction in the upper urinary tract is usually incomplete and lends itself to more deliberate consideration because of the large factor of safety and the bilateral disposition of its important organs. The opportunity for investigations so afforded should be utilized to determine by combined cystoscopic and röntgenologic examination the exact location and number of stones, the presence and degree of infection, the condition of the kidney above the obstruction and the functional and anatomical status of the opposite kidney. Chemical studies of the blood for the quantitative estimation of urea, creatinin, uric acid and glucose will serve to indicate the extent of total renal impairment, the advisability of certain preoperative precautionary measures and to act as a guide in the progress of the patient's condition. Close observation of urinary excretion as to quantity, specific gravity, the presence or absence of albumen and sugar and the microscopic contents will yield information of great value regarding renal capacity, infection, and degenerative lesions. Repeated dye tests serve as a measure of excretory function and should be compared with chemical studies of retention products in the blood.

The physical examination of the patient should be carefully made. Palpation for renal enlargement and tenderness will often give information which is otherwise unattainable. Polycystic disease of the kidneys, renal tumor, and peri-nephritic abscess are only a few of the conditions in which palpatory findings are important in diagnosis. The lower urinary tract and pelvis may contain associated lesions of the uterus and adnexa and the prostate gland, so that vaginal and rectal examinations should not be neglected.

Not all abdominal scars in cases of ureteral stone are evidence of mistaken diagnosis. We have frequently found appendicitis associated with stone in the ureter and have attended to both lesions at the same operation. In fact, in most cases of stone in the ureter, unless conditions forbid, we remove the appendix and the stone through the extra-peritoneal incision.

The percentage of ureteral stones which pass spontaneously has been

variously estimated and is probably about seventy-five per cent. This figure will vary in the experience of the individual surgeon depending upon his opinion as to the advisability of intervention and upon counsel of an associated competent cystoscopist. We believe that when there is any question as to the policy of watchful waiting, once the presence of a stone in the ureter has been established, the safer course is to proceed at once with its removal, provided there are no forbidding circumstances. It seems to us to be unwise counsel to tell a patient who has a stone in the ureter, even in the absence of symptoms, to wait for its passage or for the appearance of acute symptoms. The possibility of renal damage from back pressure and infection is ever present and is a price too dear to pay for avoiding operation or cystoscopic examination. The expert cystoscopist will succeed in the removal of many ureteral stones. The necessary diagnostic manipulations with the ureteral catheter may suffice to dislodge the stone and to favor its passage. Failing in this, deliberate and, if necessary, repeated attempts to dilate the ureter by catheter or other device and to change the position of the stone will usually accomplish its expulsion into the bladder whence it readily gains its exit. A certain degree of caution should be exercised in persistent efforts to remove a stone. Manipulations with a catheter, provided drainage is not adequate, may accentuate an already present renal infection and may necessitate a nephrectomy. Some patients are so intolerant to cystoscopy, that repeated catheterizations of the ureter are impossible and they prefer surgical removal of the stone.

The size of the stone unless more than 2 centimetres in diameter does not influence materially the procedure to be adopted for its removal. A small stone difficult to detect by X-ray may cause complete obstruction by reason of surrounding inflammatory œdema and one will often experience considerable difficulty in finding so small a stone at operation. In such cases of small obstruction stone it is advisable with the aid of the cystoscope to insert a small catheter beyond the stone thereby relieving the obstruction, and to allow it to remain in place for forty-eight (48) hours when the inflammatory reaction around the stone will have subsided. The ureter may now be dilated by inserting a series of graduated catheters; a large stone may remain in the ureter for a long time without causing acute symptoms and will be best treated by ureterolithotomy. Multiple stones in the same ureter should be removed surgically because cystoscopic procedures would require repeated attempts with the consequent liability of renal damage. Stones in both ureters or stone in one ureter with a lesion of the opposite kidney require earnest consideration as to the order of the procedure; accurate data by the use of the X-ray, cystoscope and functional tests should first be obtained. Ordinarily, the side presenting the acute symptoms should receive first attention. Otherwise, the initial procedure should be directed toward the side having the better function. When there are complicating lesions of the lower urinary tract, as obstructive hypertrophy of the prostate, then the merits of the individual case must determine the course of action. Usually, when

the prostate is the cause of much residual urine, cystostomy or prostatectomy should precede any attempt to correct a lesion of the upper urinary tract.

When the kidney above a stone in the ureter is extensively diseased as in pyonephrosis there is nothing to be gained by removal of the stone unless the kidney and a large portion of the ureter are also removed. It may be difficult to determine the condition of the kidney by cystoscopic methods so that when uncertainty exists the surgeon is obliged to explore the kidney and let the findings of direct inspection decide for or against its removal. A stone should not be allowed to remain in the ureter after nephrectomy because of the likelihood of a persistent fistula and disability from continued infection in the remaining stump of the ureter. Many cases of this type require a subsequent operation. The stone in the ureter because of its low position may be inaccessible at the time of nephrectomy and should then be pushed into the bladder with the aid of a sounder catheter inserted into the upper ureter.

We are presenting the following data on ureteral stones as a record of experience at the Lankenau Clinic from 1910 to 1925. Certain factors which influence the disposition of an individual case do not of necessity appear in statistical data; consequently, expressions of opinion and conclusions may not always have the support of figures.

One hundred thirteen patients with stone in the ureter were admitted to the Lankenau Hospital during the above period; sixty-six were operated upon and forty-seven were treated by cystoscopic methods.

In ninety-eight of the 113 cases the stone was in the lower ureter. Stones in this position are favorable for cystoscopic manipulation unless certain contra-indications are present. They may also be readily removed by ureterolithotomy. When a stone has remained for some time in the upper ureter usually at the ureteropelvic juncture it is firmly fixed, obstructs the passage of a catheter and will cause rapid and progressive impairment of renal function. Cystoscopic manipulations for dislodging it are usually of no avail. Rescue of the kidney demands prompt removal of the obstruction by uretero or pelviclithotomy. Discovery of a stone in the upper ureter when the symptoms are mild and of short duration will permit a reasonable time for its descent and possible spontaneous or induced passage. A stone does not often lodge in the middle third of the ureter, but when in this position the procedure to be adopted for its removal will depend on the acuteness of the symptoms and the condition of the kidney above it. When a stone in this position is not causing complete obstruction and the degree of infection is not severe, then cystoscopic manipulations with a catheter in an effort to dislodge it may be tried. They are often unsuccessful. Surgical removal of a stone in this position is a little more difficult than when it is in the upper or lower third, but is to be preferred because cystoscopic attempts are less certain and attended by greater risk.

In this series the stone was located in the right ureter in fifty-seven and in the left ureter in fifty-six instances.

There were forty-seven patients with stone in the ureter who were not operated on. Forty were males and seven were females. Their ages by decades were: one in the second decade, ten in the third, sixteen in the fourth, thirteen in the fifth, five in the sixth, and two in the seventh decade. In twenty-nine patients the history was acute or of only several weeks' duration. The eighteen remaining patients had had previous attacks with an average duration of symptoms of a little over three years; the longest being ten years and the shortest three months. Two patients had previously passed stones. In this group of forty-seven unoperated cases there were eleven patients who passed the stone from the ureter as the result of cystoscopic manipulations. The remaining patients were discharged from the hospital either because they refused operation or cystoscopic treatment or because they were told to allow more time for the stone to pass spontaneously.

There were sixty-six patients (forty-three males and twenty-three females) who were operated on for stone in the ureter. The ages of these patients by decades were: twenty-two in the third decade, nineteen in the fourth, twelve in the fifth, ten in the sixth, and three in the seventh decade. In fourteen patients the history was that of an acute onset or of symptoms of only several weeks' duration prior to admittance to the hospital. The remaining fifty-two patients had had one or more previous attacks with an average duration of symptoms of 3.2 years; the longest being thirty years and the shortest three months. Three patients stated that they had previously passed a stone.

The Operative Treatment of Stone in the Ureter.—Before proceeding with operative measures for removal of a ureteral stone it is essential, as previously noted, that an accurate diagnosis has been established; that the urologic status of the patient has been determined with particular reference to the opposite kidney, and the total renal functional capacity as revealed by chemical studies of the blood; that co-existent extra-urinary disease has been eliminated or taken into consideration, and in the case of the bad-risk patient that sufficient preoperative preparation has been carried out to the complete advantage of all favorable factors. When all this has been done there are still a few cases in which the choice of procedure will devolve upon the judgment of the surgeon.

The removal of a stone from the ureter may be a simple affair or a difficult undertaking, and in the event of certain complications, particularly post-operative, a wide surgical experience may be necessary to get the patient well. Consequently these patients fare better in the hands of the general surgeon or in those of the urologist who has had a general surgical training.

The choice of treatment in a case of stone in the ureter should be decided upon only after the evaluation of certain facts and circumstances. A large percentage of stones, about seventy-five per cent., will pass spontaneously. Many or most of the remainder can be made to pass by expert cystoscopic manipulations. The sifted failures of the above, and those stones obviously

unsuited for cystoscopic treatment are properly entrusted to surgical methods. Not every surgeon enjoys the coöperation of an expert urologist; consequently he will be called upon to remove more stones surgically. And properly so, since the results of operation are more satisfactory than ill-advised or improper procedures in the hands of an inexperienced cystoscopist.

It will be found advisable to make an X-ray examination for localization of the stone within twenty-four hours before operation because not infrequently the stone changes position or passes out of the ureter entirely.

Ureterolithotomy through an extraperitoneal approach is the operation of choice for stone in the ureter. To approach the upper third of the ureter, the incision is placed in the loin and resembles the one used for nephrectomy. This incision permits possible manipulation of the stone back into the pelvis of the ureter whence its removal can be accomplished with less traumatism than from the ureter proper. The kidney also is rendered available for inspection. The incision may also be extended to care for a stone in the middle third of the ureter. Or the latter may be approached through an incision to the lateral side of the rectus when it is necessary to use more care in working one's way down to the ureter by displacing the peritoneum toward the mid-line. A point of importance to remember is that the ureter is often closely adherent to the peritoneum and in the dissection is carried forward with it. Access to the lower ureter may be obtained through an incision to the lateral side of the rectus or by an incision just above Poupart's ligament. In this position the peritoneum is easily reflected and the base of the bladder exposed. Manipulations may be difficult because of the depth of the wound. The ureter should be identified and followed down to its juncture with the bladder. In performing ureterolithotomy the ureter should be secured and held by an encircling tape. This device also prevents the escape of a stone beyond reach into the upper ureter. When the stone has been found it is preferable to work it into another position in the ureter so that the longitudinal incision for its removal will not be placed in the inflamed tissues of the ureter surrounding a lodged stone. After the removal of the stone the passage-way to the bladder must be cleared by passing a ureteral catheter or probe, otherwise a persistent ureteral fistula will develop. A stone just above the bladder may be so firmly fixed that it cannot be dislodged upward and removal in situ may be very difficult. In this condition it may be possible to push it into the bladder and remove it by cystotomy or allow it to pass spontaneously. Occasionally, when a large stone is obstructed at the bladder juncture its removal may require combined intra-ureteral and intravesical manipulations. The disposition of the ureteral incision is a matter of choice. It may be left open or it may be closed by several interrupted sutures; the results are equally good. A drain must be placed down to it because there is nearly always some leakage of urine for several days. When there is much infection above the stone it is probably better not to suture the ureteral incision because free urinary drainage will be beneficial. If the incision has been closed by suture there is often temporary

partial obstruction caused by localized œdema. A stricture rarely follows the healing of anal ureter incision. When it occurs it is usually the result of the healing of a necrotic area which formed the bed of the stone or from the effects of a peri-ureteritis. A stone just above the bladder may be accessible for removal through an incision in the vault of the vagina. This applies particularly to stones which are palpable by vaginal examination.

The apparent simplicity of ureterolithotomy may be deceptive and lead to the chagrin of the surgeon who may fail to find a stone which has been demonstrated by X-ray and verified by cystoscopic examination. In a stout subject the approach may be very difficult. In three patients of this series the stone could not be found. In one of these the X-ray later showed the stone. Another patient returned three weeks later and passed a stone three centimetres in length.

Calculous ureteral obstruction is nearly always accompanied by infection of the corresponding kidney. There may be only a slight degree of pyelonephritis which will readily subside when urinary obstruction has been relieved. The infection in the kidney may be aggravated by prolonged obstruction and progress to the stage of pyonephrosis for the relief of which nephrectomy is obviously required. In not a few instances persistent efforts to dislodge a stone by cystoscopic manipulations have incited rapidly progressive renal infection with markedly septic manifestations—a condition commonly known as "acute surgical kidney," or "carbuncle of the kidney," an immediate nephrectomy must be done. As previously noted, mild pyelonephritis usually subsides after removal of the ureteral stone, but in the cases of more severe infection with hydronephrosis the surgeon may be in doubt as to the disposition of the kidney, especially when inspection is impossible. In these circumstances removal of the stone and drainage of the ureter may relieve the condition and recovery ensue. In the event the ureteral fistula fails to close or there are signs of progressive renal infection, then the kidney must be removed.

It must be admitted that an inexcusable number of patients in whom a stone has been found in the ureter possess an abdominal scar from a previous appendectomy. In many of these the operation had been done for symptoms undoubtedly caused by the stone. The error may be excusable in those cases where there has been no history of severe pain or colic and in which the symptoms for the most part have been persistent or recurrent dull pain in the right lower abdomen with mild reflex gastric disturbances. Such symptoms are not uncommon with stone in the ureter, but occur with greater frequency in appendicitis. Chronic appendicitis or some other surgical lesion may co-exist with a stone in the ureter. To correct one condition and not the other is to obtain an unsatisfactory result. We venture to say that some patients are unrelieved of their abdominal symptoms following removal of a stone from the ureter. With this in mind, it has been our practice when operating for ureteral calculus to remove the appendix as well as the stone where the symptoms have warranted this procedure. Usually, the operations

can be done through the same incision. The appendix is removed first, the peritoneum securely closed and then an extraperitoneal exposure of the ureter is made.

Summary of Operative Data

	Cases
Ureterolithotomy	31
Stones removed from two incisions in ureter	1
Two stones removed	1
One stone removed and another pushed into bladder. (This patient had a nephrectomy later because of a ureteral fistula.)	1
Double ureter	1
Kidney and ureter removed later	1
Ureterolithotomy combined with appendectomy	12
Salpingectomy	1
Ureterotomy combined with transvesical removal of stone	4
Nephrectomy five weeks later—stones in remaining kidney	1
Ureterotomy combined with removal of stone from lower ureter via vagina	1
Exploration of ureter extraperitoneally and by cystotomy but no stone found	3
Stone later shown by X-ray	1
Returned three months later and passed a stone 3 inches in length	1
Pelviolithotomy	3
Nephrectomy	5
Primary	3
Secondary	2
Transvesical removal of stone from ureter	7
Stone pushed back in ureter and then removed through loin	1

Mortality.—There were no deaths following simple removal of a stone from the ureter.

One patient died following nephro-ureterectomy for infected kidney caused by a stone obstructing the lower ureter.

PROBLEMS RELATED TO SURGICAL LESIONS OF THE KIDNEY *

By Verne C. Hunt, M.D.

of Rochester, Minnesota

From the Division of Surgery, of the Mayo Clinic

Certain well-defined principles have been established in the treatment of most of the surgical lesions of the kidney. However, the problems encountered in the consideration of the surgical lesions of the upper part of the urinary tract are not confined to surgical methods which today are fairly well understood and universally employed. Many of the technical surgical procedures have been so uniformly standardized that little may be presented to add to present-day knowledge of the execution of the usual operations on the kidney. Many problems are presented in the determination of whether a lesion exists, whether it is best treated by surgical or nonsurgical methods, and if it is determined to be surgical, whether conservative or radical procedures shall be employed.

It is not my purpose to review the various surgical lesions of the upper part of the urinary tract, but to present for your consideration some of the problems attendant on the treatment of lithiasis, renal tuberculosis, and neoplastic disease.

We are all aware of the painstaking effort, so necessary on the part of the urologist, to establish a diagnosis of a surgical lesion of the urinary tract and the necessity for care in the selection of procedures incident to urologic diagnosis, and competent interpretation of data. The symptoms of intra-abdominal disease and those of disturbances of the urinary tract are often sufficiently atypical, not only to be confusing in diagnosis, but to be entirely misleading. The frequency with which the gall-bladder or the appendix or both have been removed for symptoms that have been produced by primary disease of the urinary tract emphasizes the necessity of urologic investigation if there is doubt regarding the accuracy of the diagnosis. If there are subjective data referable to the urinary tract, or if blood and pus cells are found in the urine, the urinary tract should be regarded with suspicion, until, by subsequent investigation, such suspicion is proved well founded or may be dispelled. The presence of pus or blood or both in the urine may be the result of disease in any part of the urinary tract, and it is noteworthy that at times such are the only data that may lead to investigation of the urinary tract and to the discovery of a pathologic condition, which has remained silent so far as subjective symptoms are concerned.

Lithiasis.—Lithiasis is the most common surgical lesion in the kidney. During recent years, approximately 50 per cent. of the operations performed on the kidney at The Mayo Clinic have been for lithiasis. The incidence has perhaps been no greater than formerly, but the careful clinical examina-

* Read before the Society of Alumni of Bellevue Hospital, New York, October 2, 1929.

tion of patients, and the investigation of symptoms and objective data, have led to the discovery and diagnosis of lithiasis much more frequently in recent years.

As yet no clear conception of the etiology of lithiasis has been presented, but clinical and experimental investigation has resulted in the exposition of certain significant factors. The theory that remote foci of infection are instrumental in the development of lithiasis has received much support. Considerable evidence has accumulated tending to indicate that perhaps chemical changes incident to the advent of bacterial invasion of the kidney and urine may be instrumental in the precipitation and agglutination of the normal constituents of urine, the oxalates, urates, and phosphates, the most common constituents of calculi. Rosenow has shown that certain strains of bacteria possess definite specificity, and clinical observation has shown that the elimination of active foci of infection has usually resulted in the cessation of the process of recurrent formation of stones in patients who possess a so-called stone-forming kidney. At any rate, and whatever all the factors involved may be, experience has shown that treatment of patients with renal lithiasis is incomplete without the investigation and elimination of all remote foci of infection.

Braasch has presented data to show that stones in the kidney are multiple in more than 40 per cent. of the cases, and that they are bilateral in approximately 10 per cent. At times, stones in the kidney are associated with stones in one or the other or both ureters, which contributes materially to the difficulties of determining proper methods of treatment. Various combinations, such as unilateral renal lithiasis, with ureteral lithiasis of the same side, unilateral renal lithiasis with bilateral ureteral lithiasis, bilateral renal lithiasis with unilateral ureteral lithiasis, and most infrequently, bilateral renal and ureteral lithiasis are encountered. Ureteral stones are associated, however, in less than 5 per cent. of cases of renal lithiasis.

The complications of infection, urinary obstruction, and destruction of renal function provide problems in the treatment of renal lithiasis not always easy of solution. Renal stones may not produce symptoms, and these have been referred to as silent stones. It is true that they may be silent so far as the production of symptoms is concerned, but seldom, if ever, are stones silent so far as their effect on the kidney is concerned. In the presence of calculi there is always some infection in the kidney which varies in degree from the intermittent presence of a few pus cells in the urine to the extreme degree of extensive pyonephrosis with complete destruction of all function. Reduction of function, as determined by the differential functional tests, is often observed in the presence of lithiasis, and many times the functional tests provide a reading so low that it is out of all proportion to the amount of actual injury to renal tissue, which may be misleading. Many cases have been observed in which the differential functional tests showed such marked reduction of function in the presence of lithiasis that one would be led to suspect considerable injury to the kidney; however, at operation a fairly sound

kidney has been found, which subsequent to operation has returned to normal function, at least so far as the functional tests are concerned. It has been suggested that perhaps, through the sympathetic nervous system, stones may influence partial inhibition of renal activity. At any rate, whatever the factors may be, a small return of the dye in a differential functional test, in the presence of lithiasis, should not always abruptly lead to the conclusion that the kidney is as badly injured as the low functional test might indicate.

The significance of the complications of infection, urinary obstruction, and destruction of renal function, is emphasized by the frequency with which the radical operation of nephrectomy is necessary in treating renal lithiasis. In a recent review of 941 cases of renal lithiasis in which operation was performed at The Mayo Clinic during the years 1922 to 1928 inclusive, I found that nephrectomy was necessary in 334 cases (35 per cent.) on account of the degree of infection and destruction of renal tissue. Such a high incidence of nephrectomy reflects unfavorably on conservative non-operative methods.

The question often arises as to which renal stones are of surgical significance and when operation should be done. I believe that with an occasional exception, and in the absence of contraindications, that in practically all instances renal stones should be removed as soon as their presence is known. Furthermore, in the interest of conservatism and preservation of kidneys, it is most important to recognize the presence of renal lithiasis earlier than in the past, to facilitate the conservative removal of stones before such extensive injury has occurred as to make nephrectomy necessary.

It is true that small renal stones will pass, and many do pass. Practically all ureteral stones have originated in the kidney. One may not safely use the size of stones encountered in the ureter as a guide in determining whether or not a renal stone will pass. Many stones leave the kidney to make their passage satisfactorily to the bladder, but these must necessarily be small. Stones may pass from the kidney and become impacted only when they reach the ureterovesical juncture, where in many instances they may be aided in passage by non-surgical methods. In general, so far as size is concerned, it may be stated that if a renal calculus found in the course of a clinical examination, has not produced subjective symptoms, and is less than approximately 0.5 centimetre in diameter, its removal is not particularly urgent. An opportunity should be afforded for spontaneous passage. If, after observation for a period of weeks or months, the position does not change, but the size increases, it is most conservative to consider early removal. On the other hand, repeated renal colic from a calculus of any size retaining its position in the kidney furnishes sufficient and just indication for removal. A renal calculus in the aged, which is and has been silent so far as symptoms are concerned, and when good renal function has been maintained, furnishes another exception to the rule that renal calculi should be surgically removed when the diagnosis is established. In such instances, the mere presence of a stone manifests little, if any, influence on life expectancy, and operation is best postponed until indications for removal occur.

Considerable difference of opinion has existed regarding the branched stone, particularly when it is encountered in the absence of symptoms, and there is minimal infection, and little, if any, reduction of function. In the past, under just such circumstances, there has been a strong justifiable tendency toward observation and postponement of surgical procedures until indications for removal have developed. This has been especially logical when large branched stones have been bilateral. In the past, large branched stones have been removed with great difficulty and with such extensive mutilation of the kidney as to require either primary or subsequent nephrectomy. In recent years some progress has been made in conservative removal by the process of crushing the stone *in situ* before removing it piecemeal through the renal pelvis. If branched stones are causing symptoms, and their presence is resulting in injury to the kidney, the question of conservative removal or nephrectomy is not always easily decided. In the presence of adequate renal function, conservative removal of the stone is the procedure of choice. Nephrectomy certainly is easier than the conservative operation in cases of large branched stones; however, conservation of renal tissue under difficulties distinguishes the work of the surgeon from that of the "operator."

When ureteral lithiasis is associated with renal lithiasis it is not always possible to determine the status of the kidney, as regards the amount of infection and its function, previous to removal of the ureteral calculus, particularly if the ureter is impassable to a catheter. In such instances, it has proved best to remove the ureteral calculus first, if it has been situated in the lower half of the ureter, and determine the renal function and degree of infection later. If a ureteral calculus is situated in the upper half of the ureter it may be removed simultaneously with the stone or stones from the kidney through a posterior incision, if a conservative operation can be accomplished, or simultaneously with nephrectomy, if the indications are clear for the radical operation. In case of the latter necessity, nephroureterectomy to just below the ureteral stone has proved the procedure of choice.

Bilaterality of renal lithiasis is serious in direct proportion to the amount of renal injury and infection. Except under most unusual circumstances, it has not been advisable to operate on both kidneys simultaneously, but, everything else being equal, it has been best to operate on that side first to which the acute symptoms, if any, have been referable. In the absence of acute symptoms, but with difference in function of the two kidneys, it has seemed best to operate first on the kidney with the better function.

In my experience with the conservative operations for removal of stones from the kidney it has been possible to remove stones by pelviolithotomy in 85 per cent. of the cases. The operation of nephrolithotomy, or incision through the cortex of the kidney, has been reserved for cases in which the stones were inaccessible through the pelvis, in that they were encysted in the terminal calices and were situated rather superficially under the renal capsule.

It is noteworthy that the mortality rate is somewhat greater when con-

servative non-operative methods, or late recognition of the presence of lithiasis, have allowed infection and reduction of function to proceed to the extent that nephrectomy is necessary, than when the conservative operations of pelviolithotomy or nephrolithotomy may be employed. In the series of 941 cases of lithiasis there were fifteen deaths, a mortality rate of 1.6 per cent. The mortality rate in 607 cases in which the conservative operations were employed was 1.3 per cent. as opposed to 2.1 per cent. in the cases in which nephrectomy was necessary.

Reformation of renal calculi after conservative operation occurs through the persistence of preëxisting foci of infection and other indeterminate factors entering into the formation of stones. There are so-called stone-forming kidneys in which calculi continue to develop even after all demonstrable foci of infection have been eliminated. However, true reformation of stones occurs rather infrequently, and experience has shown that the relatively high incidence of so-called reformation of stones has in reality been the continued development of stones overlooked at the time of operation, or of particles that were not removed, and which served as nuclei for subsequent stones. Surgeons of wide experience, in operating for renal lithiasis, have all suffered the humiliation of being unable to find enough stones at operation to account for all the shadows in the röntgenogram, and of having shadows persist after operation. Likewise, shadows often have been found immediately after operation, when the surgeon was certain that he had removed all stones completely. In other words, the oversight of one or more stones at operation, or their incomplete removal, is a most significant factor in the reformation of stones. Röntgen-ray examination, in all cases, a few days after operation is the only means of distinguishing between stones that have been overlooked and true subsequent recurrence.

You are all familiar with the method of fluoroscopic examination of the kidney at operation as devised by Braasch and Carman. This procedure has been employed at The Mayo Clinic for a number of years, most advantageously, as an aid to the surgeon in localizing single or multiple stones which otherwise could not have been found, and has provided relative assurance that the kidney is clear of stones at the conclusion of the operation. Although the procedure is not infallible, it is noteworthy that the postoperative röntgenogram seldom depicts a persisting shadow in the region of the kidney when the kidney was found to be clear on fluoroscopic examination at the conclusion of the operation.

Quinby has advocated the making and developing of films at operation as an aid in the localization of stones, and for the assurance of complete removal of all stones. These methods have attained such significance in the surgery of renal lithiasis, that to insure the best results, it is questionable whether one is justified in contemplating pelviolithotomy, particularly for multiple stones, without fluoroscopic aid or without facilities for the rapid development of films at operation.

Renal Tuberculosis.—The upper part of the urinary tract seldom is alone

the site of tuberculosis, and primary tuberculosis of the urinary tract seldom, if ever, occurs. It is generally accepted that tuberculosis of any part of the genito-urinary tract is hæmatogenous in origin. The high incidence of pulmonary tuberculosis in general necropsy records would seem to indicate that the lungs act as the primary focus for secondary dissemination through the blood stream. In fully 80 per cent. of the cases of renal tuberculosis there is associated tuberculosis elsewhere; however, in the absence of contraindications or of activity of a major tuberculous lesion elsewhere, associated lesions should not necessarily deprive the patient of the benefit to be obtained from removal of the major tuberculous lesion if it is in one kidney. Although heliotherapy and nonsurgical methods of treatment have been advocated, and unquestionably possess some merit, the cure of unilateral renal tuberculosis is usually not accomplished except by nephrectomy.

As regards the diagnosis, it may be stated that the clinical recognition of renal tuberculosis has reached a high state of accuracy, although there is considerable difference of opinion regarding the relative merits of certain data on which the diagnosis may be based. Wildbolz, Braasch, Thomas, Medlar and others have called attention to the difficulty encountered in the proper interpretation of the presence of the bacilli of tuberculosis in the renal secretion, the one bit of evidence which has been accepted as most conclusive that renal tuberculosis exists in the kidney from which such secretion has been obtained.

Wildbolz stated that the demonstration of bacilli of tuberculosis in the renal secretion by no means signifies that the corresponding kidney is the seat of specific tuberculous tissue changes and that the presence of bacilli in the renal secretion may be due to so-called bacilluria, especially in patients with advanced pulmonary lesions, without there being any tuberculous changes in the kidney. Medlar and others are of the opinion that bacilluria is evidence of tuberculous disease in the kidney. Thomas stated that never has he removed a kidney which eliminated bacilli of tuberculosis that did not contain a lesion of tuberculosis. These opposing opinions are presented to show cause for the wide variation in the incidence of bilateral renal tuberculosis. Wildbolz reported bilaterality in 12 per cent. of his cases, whereas Thomas reported bilaterality in 55 per cent., stating that inasmuch as all renal infections in which bacilli of tuberculosis are present are hæmatogenous in origin, both kidneys are infected equally and that bilateral infection is the rule.

In an effort to determine the incidence of bilaterality of renal tuberculosis at The Mayo Clinic, I recently reviewed the operative and non-operative cases that have come under observation during the ten-year period from January 1, 1919, to January 1, 1929. During this time nephrectomy was done in 574 cases and 264 non-operative cases were observed. In this latter group the diagnosis of renal tuberculosis was definitely established and all of the cases were considered non-surgical, with the exception of forty-three in which nephrectomy was advised but was not accepted by the patient. In other words, approximately 73 per cent. of the cases of renal tuberculosis

were regarded as suitable for nephrectomy. The remaining 221 cases were considered non-surgical because of bilaterality in seventy-seven, occlusion and relative freedom from symptoms in forty-eight, active and advanced pulmonary tuberculosis in thirty-seven, and extensive and advanced tuberculosis elsewhere, local or generalized, in thirty-eight. In ten cases, in which nephrectomy had been performed for tuberculosis of one kidney, tuberculosis of the remaining kidney was found; in four non-operative cases, bilateral renal tuberculosis was proved at necropsy. The remaining seven cases were considered non-surgical on account of associated malignant or serious non-tuberculous constitutional disease. The diagnosis of bilaterality in the seventy-seven cases was definitely established in most instances through the presence of bacilli of tuberculosis in the secretion from both kidneys, or through inoculation of guinea pigs. Definite evidence of bilateral renal tuberculosis existed in ninety-one of the non-operative cases. Among those cases in which nephrectomy was done, evidence of bilaterality existed in twenty and included those cases studied by Braasch and Morse. The diagnosis of bilaterality in these cases was established either from the finding of bacilli of tuberculosis in the secretion from both kidneys, previous to, or subsequent to, operation or from the positive findings from both sides, obtained through inoculation previous to, or subsequent to, operation. In other words conclusive evidence of bilaterality existed in 111 of the entire series of 838 operative and non-operative cases, an incidence of 13 per cent., which I am confident expresses a liberal incidence of bilaterality in the series.

Nephrectomy in the presence of bilateral renal tuberculosis is seldom indicated or justifiable; however, it may occasionally be considered if there is much pain, hæmaturia, or acute sepsis in one kidney and if the other side is but slightly involved. It may be considered also when, after prolonged observation, bilaterality of the condition becomes questionable. An example is that of a patient who came to The Mayo Clinic in July, 1923, at which time the guinea-pig test was positive for tuberculosis in both kidneys, and non-surgical measures were instituted. The patient returned in April, 1926, in good condition, and a diagnosis of unilateral involvement only was made and right nephrectomy was done. One year later the patient was again carefully examined and no evidence of tuberculosis of the urinary tract was to be found.

As to whether or not nephrectomy should be considered in the presence of tuberculous lesions elsewhere depends largely on the degree of activity of the various tuberculous lesions. Certainly, in the absence of general contraindications, if the tuberculous kidney is the most important tuberculous lesion, its removal is justly indicated. The low primary mortality rate following nephrectomy for unilateral renal tuberculosis justifies the operation even if there is moderate pulmonary involvement. There were fourteen deaths, a mortality rate of 2.4 per cent., in the series of 574 cases in which nephrectomy was done for renal tuberculosis; however, in the last 357 of these there were but seven deaths, a mortality of 1.9 per cent. In general, there has been a

late mortality of 20 per cent. within five years, with partial recovery in 80 per cent. of the patients; 60 per cent. have been completely cured, and 20 per cent. have had persisting vesical symptoms. The shorter the duration of the disease and the less extensive the renal involvement and cystitis, the better the result. Braasch recently reviewed sixty-five cases in which nephrectomy was done between five and fifteen years ago and in which advanced secondary ulcerative cystitis was present with markedly reduced capacity of the bladder. Among these, there was a five-year mortality of 37 per cent. The condition of the bladder in 30 per cent. of patients who were living was not improved. Early nephrectomy, before advanced involvement of the bladder occurs, insures materially better results than may be expected in those cases of advanced involvement of the genito-urinary tract.

Indolent healing of the wound and a temporarily persisting sinus usually is due to perinephritic involvement, incomplete removal of diseased tissue, persisting infection of the ureter, and the institution of drainage. Thorough removal of perirenal fat, accurate hæmostasis, partial ureterectomy, as low as possible, through the primary incision, with sterilization by cautery of the stump after secure ligation, afford closure of nephrectomy wounds without drainage and result in primary healing in a high percentage of cases.

Neoplastic Disease.—In the consideration of malignant disease of the kidney it is most essential that diagnosis be made early to insure the best results. Unfortunately, extensive advancement often occurs silently, so far as subjective symptoms are concerned, an operability frequently is questionable. Most malignant lesions of the kidney tend to metastasize rapidly, through local extension, to perirenal structures and the renal vein, which provides direct avenues for remote metastasis. In the absence of demonstrable metastasis and fixation of the kidney by direct extension to surrounding structures, nephrectomy affords the best prognosis. The anterior transperitoneal route facilitates removal of large tumors entirely inaccessible through the usual posterior incision.

Within the last year, Hager and I reported a statistical review of 271 cases of malignant neoplasm in which the various types of tumors, methods of treatment, and results, were presented. My reason for including at this time any consideration of neoplastic disease of the kidneys is to emphasize the necessity of pre-operative recognition or identification at operation of papillary epithelioma of the renal pelvis, which usually is a lesion of a relatively low degree of malignancy and differs from all other neoplasms of the kidney in its manner of extension and advancement and in which simple nephrectomy does not suffice. Papillary epithelioma of the renal pelvis progresses, not by invasion of parenchyma and surrounding structures, but by extension along the mucous membrane of the pelvis to the calices, and along the ureter to the bladder. In the past, unless the bladder has been involved, the surgical procedures have been limited usually to nephrectomy, with subsequent recurrence of hæmaturia, indicating subsequent ureterectomy. Some time ago I reviewed the cases of papillary epithelioma of the renal pelvis observed at

The Mayo Clinic; in two-thirds of the cases the bladder was involved at the time of examination, or it became involved after nephrectomy or after nephrectomy and partial ureterectomy. The high incidence of metastasis to the portion of the bladder immediately surrounding the ureteral orifice, or immediately adjacent to it, emphasizes the necessity of segmental resection of the bladder with the inclusion of the intramural portion of the ureter and the adjacent area simultaneously with nephro-ureterectomy.

Much might be said in the consideration of malignant lesions of the kidney, however, I would emphasize that an operable tumor of the kidney, in the absence of contraindications always is a surgical condition and that good results are dependent on early diagnosis and early operation.

URETEROPYELONEPHROSTOMY FOR URINARY OBSTRUCTION AT THE URETERO PELVIC JUNCTION*

By Waltman Walters, M.D.

of Rochester, Minnesota

division of surgery, of the mayo clinic

Ureteropyelonephrostomy, or the anastomosis of the pelvis of the kidney, and the ureter, may be followed by highly satisfactory results. Reviews of literature of plastic operations on the renal pelvis and ureter have been made by Adrian and Lichtenberg,[1] Kroiss,[3] Weinberg,[6] and Loux.[4] Weinberg performed ureterorrhaphy successfully for stricture and stone in a case of solitary kidney. One of the most interesting cases of this type was reported by Bazy.[2] The patient was a boy, ten years of age, on whom Bazy performed ureteropyelonephrostomy in 1904. Six years later, examination revealed the anastomosis to be functioning satisfactorily.

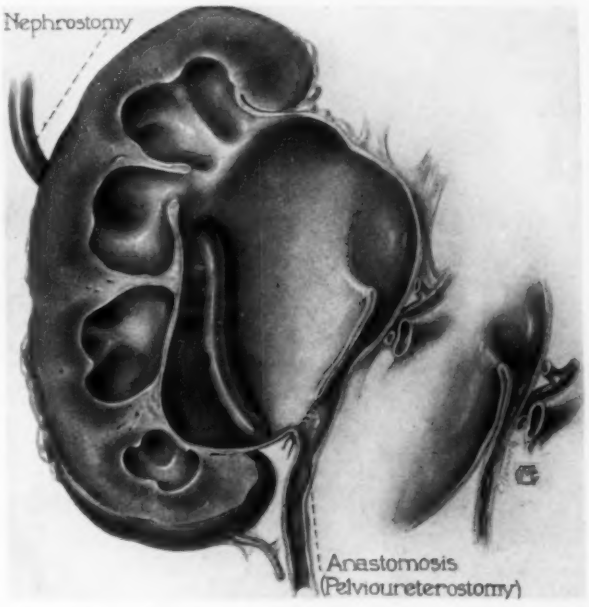

Fig. 1.—Case I. Ureteropyelonephrostomy and nephrostomy (solitary kidney).

A review of the literature on ureteropyelonephrostomy leads one to believe that if the anastomosis is correctly made, it will function satisfactorily. In the two cases reported here the anastomosis was successful.

Case Reports.—Case I.—A man, thirty-five years of age, had had left nephrectomy for stone elsewhere. In 1926, he had begun to have attacks of intermittent renal colic, with distention of the right kidney. Intermittent ureteral catheterization had been necessary. In August, 1928, prior to admission, he had suffered a similar attack, but removal of the catheter from the right renal pelvis had been followed by recurrence of symptoms, and urine did not drain from the kidney. With the ureteral catheter in the kidney, the excretion of phenolsulphonephthalein was 40 per cent. in two hours. August 15, cystoscopic examination revealed a single right hydronephrotic kidney, with a capacity of at least 150 cubic centimetres. Pus in the urine was graded 1.

The blood urea varied from 28 to 40 milligrams in each 100 cubic centimetres. August 15, 1928, ureteropyelonephrostomy was performed. Anastomosis was made between the ureter and pelvis at the most dependent portion of the pelvis. The kidney was hugely

* Submitted for publication August 15, 1929.

hypertrophied and the pelvis was greatly distended. Obstruction at the ureteropelvic juncture was caused by pressure on the renal pedicle. Nephrostomy was done simultaneously to remove tension from the anastomosis. (Fig. 1.) Fifteen days after the operation the wound was healed and from 2000 to 3000 cubic centimetres of urine was passed from the urethra daily. The patient gained in weight and his general condition was excellent. In May, 1929, the patient reported his condition to be excellent, except for the fact that he found it necessary to lie down once or twice a day in order completely to empty the kidney.

Cystoscopic examination, June 10, revealed retention of 30 cubic centimetres of slightly turbid urine in the right renal pelvis. Indigocarmine appeared in the urine eight minutes after intravenous injection and was excreted in normal quantity. A No. 10 Garceau catheter slipped easily into the renal pelvis. Blood urea was estimated at 38 milligrams in each 100 cubic centimetres. Ptosis of the right kidney led to the belief that it was producing some angulation of the anastomosis when the patient was in the upright position, and nephropexy was done, June 26. July 3 he was out of bed and the kidney was emptying completely.

FIG. 2.—Case II. Pre-operative pyelogram showing obstruction at ureteropelvic junction.

CASE II.—A man, twenty-four years of age, had undergone operation elsewhere for removal of a calculus from the pelvis of the right kidney in March, 1928. Post-operative obstruction at the ureteropelvic junction had occurred, producing attacks of pain in the right renal region.

Cystoscopic and pyelographic examination, March 15, 1929, showed the right ureter occluded at the ureteropelvic junction. From the right kidney, however, some urine was draining which contained pus, graded 3. An attempted pyelogram of the right kidney showed that the opaque substance did not enter the pelvis. (Fig. 2.) Excretion of phenolsulphonephthalein from the right kidney was estimated as a faint trace and that from the left kidney as 10 per cent. The return of indigocarmine from the right kidney was graded 3 and that from the left kidney, 4. The left kidney was normal.

Operation was performed, April 2, 1929. Obstruction from a dense scar was found at the right ureteropelvic junction. Ureteropyelonephrostomy and nephrostomy were performed. (Fig. 3.)

The post-operative course was uneventful. Post-operative cystoscopic and pyelographic examination, June 12, 1929, showed good urinary drainage from the right kidney. The urine was practically normal. Indigocarmine from the right kidney was graded 2 and that from the left kidney, 4. The anastomosis was patent and well shown in the pyelogram. (Fig. 4.) There was dilatation of the pelvis and upper calix. The general condition of the patient was excellent at the time of his dismissal, June 28.

TECHNIC OF URETEROPYELONEPHROSTOMY

In the two cases reported here, lateral anastomosis was made between the ureter and the dependent portion of the hydronephrotic renal pelvis. (Fig. 1.) A ureteral catheter was used temporarily through the anastomosis to serve as a scaffolding for healing.

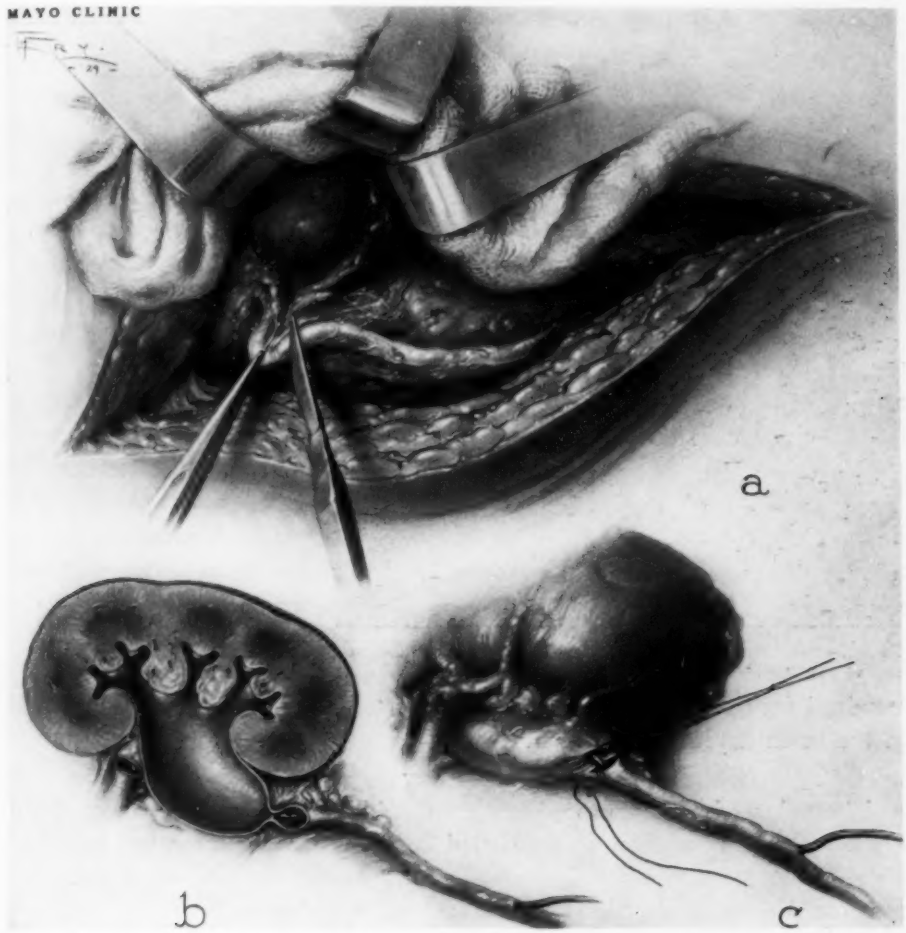

FIG. 3.—Case II. *a*, Freeing of scar tissue causing angulation of the ureter below true obstruction; *b*, true obstruction at the ureteropelvic juncture found by using ureteral catheter as probe; *c*, lateral anastomosis (ureteropyelonephrostomy).

In the first case the catheter had been inserted in the ureter in order to decompress the renal pelvis and was there at the time of operation. It was carried into the pelvis through the anastomosis and maintained in place for twenty days, when it was removed. In this case also temporary nephrostomy was done to prevent tension on the anastomosis, a number 14 French catheter being used. The catheter was removed on the eighth day.

In the second case, the cause of the obstruction was a dense scar of

fibrous tissue at the ureteropelvic juncture. Connective tissue had extended to a point below this, angulating the ureter as shown in figure 3, *a*. When first exposed this angulation appeared to be the site of obstruction. After it was free, however, an opening was made in the ureter about 3 centimetre distal to this point and a catheter was pushed toward the renal pelvis as a probe. It was then found that the obstruction had not been relieved but existed at the ureteropelvic juncture. (Fig. 3, *b*.) Dissecting up the ureter to this point, the obstruction was found and a lateral anastomosis was made between the ureter below and the pelvis above. (Fig. 3, *b* and *c*.) Two rows of chromic catgut were used in both cases in making the anastomosis. (Fig. 3, *c*.) A ureteral catheter was carried through the anastomosis and out of the incision through the ureterostomy opening. It remained for thirteen days. A nephrostomy tube was also used and removed on the tenth day after operation.

FIG. 4.—Case II. Post-operative pyelogram following ureteropyelonephrostomy showing anastomosis patent.

SUMMARY

The value of plastic procedures on the kidney, pelvis and ureter from which the urinary outflow is obstructed is emphasized in these two cases of ureteropyelonephrostomy, in one of which the operation was one of necessity and was life-saving, in view of the fact that the obstruction at the ureteropelvic juncture was complete and the kidney was solitary. Infection in the kidney operated on does not seem to complicate surgical results, as may be noted in Case II. Subsequent to operation the degree of infection of the kidneys is diminished and the function of the kidney improved. Additional cases of heminephrectomy, as well as resections of the hydronephrotic renal pelvis reported elsewhere,[5] further tend to bear out these conclusions.

BIBLIOGRAPHY

[1] Adrian and Lichtenberg: Quoted by Young, H. H., and Davis, E. G.: Double Ureter and Kidney, with Calculous Pyonephrosis of One-Half; Cure by Resection. The Embryology and Surgery of Double Ureter and Kidney. Jour. Urol., vol. i, pp. 17–57, 1917.

[2] Bazy, P.: Hydronéphrose. In: Encyclopédie française d'urologie. Paris, Octave Doin et fils, vol. iii, p. 159, 1914.
[3] Kroiss: Quoted by Loux.
[4] Loux, H. R.: Plastic Surgery of the Kidney, Pelvis and the Ureters. Jour. Am. Med. Assn., vol. lxv, pp. 1237–1243, 1915.
[5] Walters, Waltman and Braasch, W. F.: Resections of the Renal Pelvis, the Kidney and Ureter for Urinary Obstruction and Hydronephrosis. Report of Nine Cases. Jour. Am. Med. Assn. (In press)
[6] Weinberg: Quoted by Loux.

TUBERCULOSIS OF THE PROSTATE GLAND *

By Oswald Swinney Lowsley, M.D.
AND
John Duff, M.D.
OF New York, N. Y.

FROM THE DEPARMENT OF UROLOGY (JAMES BUCHANAN BRADY FOUNDATION) OF THE NEW YORK HOSPITAL

Tuberculosis of the prostate is a frequent accompaniment of genital tuberculosis and does not occur so often in urinary tuberculosis. In fact the great wonder is that the prostate is not involved in 100 per cent. of the cases of genito-urinary tuberculosis, occupying as it does a prominent position at the junction of the urinary and genital tracts. It is indeed strange that the prostatic duct orifices, numbering over 60 on the average, may be constantly bathed in tuberculous urine for years and in at least 30 per cent. of the cases escape any tuberculous infection that is appreciable by the palpating finger.

Our interest in this type of case was aroused first by an operation done many years ago by Dr. David W. MacKenzie, at Bellevue Hospital, at which a prostate suspected of having a carcinomatous nodule was found to have a tuberculous calcified area apparently primary although the patient was a colored man and the members of his race are noted for the frequency with which tuberculosis occurs.

Another case suffering from tuberculosis of the prostate and membranous urethra with a so-called watering pot perineum was operated upon several times and finally all of the little sinuses healed thoroughly and in a spectacular manner when the patient was subjected to Alpine light treatment.

We were under the impression that we had found two cases of primary tuberculosis of the prostate but intensive study caused us to doubt that the evidence at hand was entirely conclusive so are obliged to present these cases as secondary to some other lesion in the body.

Tuberculosis seems to affect the epididymes most often of all the genito-urinary organs. The kidney is probably next in freqency of attack followed in close order by the ureters and bladder. The seminal vesicles are occasionally the site of tuberculosis, usually following a long-standing tuberculous epididymitis, and the prostate is least often affected and primary tuberculosis of the prostate is extremely rare.

A little over two per cent. of pulmonary tuberculous cases show, at autopsy, tuberculosis of the genito-urinary tract. Saxtoff of Copenhagen reports 547 cases of urogenital tuberculosis in 10,016 autopsies. Cornet, reviewing the records of 10,000 autopsies found that, excluding pulmonary tuberculosis, less than 100 were urogenital. Kapsammer records about 200 cases of urogenital tuberculosis from 20,700 post-mortem examinations. Hesse states that 232 cases of tuberculosis of the genito-urinary tract were discovered in a series of 10,864 autopsies and Krzywicki twenty-five in 500.

* Read before The Western Urological Association, July 5, 1929.

Seventy per cent. of the cases of urogenital tuberculosis demonstrate coincident tuberculosis of the prostate and a very small fraction of 1 per cent. primary tuberculosis of the gland. Krzywicki discovered in fifteen cases of urogenital tuberculosis that the prostate was tuberculous in fourteen. Hesse in his review of 15 cases found 554 with prostatic tuberculosis. Barney and Cabot found it in seventy-five out of 101 cases. Oppenheim reports thirty-seven cases of urogenital tuberculosis in eighteen of which a tuberculous prostate was also discovered. Collenet reports forty-four cases of prostatic tuberculosis in seventy patients with tuberculosis elsewhere in the urogenital tract. Halle and Motz demonstrated fifty-nine cases of tuberculous prostatitis in a series of seventy-two and Simmonds twenty-six in his report of thirty-five cases of urogenital tuberculosis.

The proportion of pulmonary tuberculous cases which show at autopsy tuberculosis of the genito-urinary tract, is demonstrated in Table A, which gives the percentage of urogenital tuberculosis in about 52,000 autopsies.

TABLE A

Reported by	Autopsies	Urogenital Tuberculosis
Kapsammer	20,700	200
Collenet	10,000	100
Saxtoff	10,016	547
Hesse	10,864	232
Krzywicki	500	25
	52,070	1,104—2.1%

Tuberculosis of the prostate in itself is not common but it is present in about 70 per cent. of the cases of urogenital tuberculosis. Table B clearly illustrates this fact.

TABLE B

Reported by	Urogenital Tuberculosis	Prostatic Tuberculosis
Krzywicki	15	14
Hesse	815	554
Barney, Cabot	101	75
Oppenheim	37	18
Collenet	70	44
Halle, Motz	72	59
Simmonds	35	26
	1,145	790—68.9%

Thus it is clear that when tuberculosis of the urogenital tract is discovered despite the fact there may be no symptoms of prostatic involvement, a most careful examination of this gland should be made in order that the immediate and future treatment be appropriate and the prognosis appreciated.

TABLE C

Reported by	Prostatic Tuberculosis	Pulmonary Tuberculosis
Desnos	16	6
Julien	41	23
Krzywicki	14	12
Oppenheim	100	81
Rautbard	100	85
Reclus	100	98
Young	342	96
Socin	52	41
	765	442—57%

Having reviewed the literature very carefully we have been able to find but one case in which tuberculosis of the prostate was undeniably primary. This case was reported by Crandon with complete autopsy and pathological reports. Barney and Koll each report a case which may have been one of primary tuberculosis of the prostate but there was no Röntgenological examination of the chest reported in either case. Such an examination either fluoroscopically or film, is necessary in conjunction with physical examination to rule out the presence of old or quiescent pulmonary lesions. Koll states that his patient had no reaction to large doses of tuberculin. This fact is good circumstantial evidence but not conclusive. Salleras describes a case of primary tuberculosis of the prostate and his report is quite convincing. He reports negative X-ray and cystoscopic examinations but according to present-day laboratory standards his report is not complete.

Whether the prostate is the site of primary tuberculous infection is of academic interest only and, because it is so extremely unusual, of practically no surgical importance.

The diagnosis of tuberculosis of the prostate is difficult. It is especially so when it occurs, as it occasionally does, in conjunction with benign adenomatous hypertrophy or when in a patient of cancer age, hard nodules are discovered on digital examination. Nevertheless if we remember that in all cases of urogenital tuberculosis the prostate is involved in 70 per cent., earlier diagnoses can be made and the chance for cure or lengthening of life proportionately increased.

The cases which we have collected number twenty-three and of these it was thought that two were probably primary lesions in the prostate but a thorough examination of the patients cast some doubt on the cases being primary in the prostate gland.

The cases collected are shown in detail in the accompanying chart:

By an examination of this chart it will be seen that tuberculous involvement of the prostate gland is a disease of young adult life, our cases varying in age from twenty-four to sixty-nine, the average being thirty-two years.

Among these twenty-five cases there were sixteen patients with tuberculosis of the epididymes, two of which at operation had severe involvement of

Name and No.	Age	Diagnosis and method of investigation	Operative	Non-operative diet, rest, fresh air, Alpine light	Tuberculin	Results				
						Cured	Improved	Unimproved	Dead	Remarks
1. S. L., No. 275965	26	T.B. bladder, lungs, kidneys	None—cystoscoped	Our regular routine	None				Yes	Rectal examination reveals a large mass which is typical of T.B. prostate.
2. P. M., No. 269458	25	Nephrectomy (R), partial ureterectomy		Lamp treatment	None		Yes			Rectal examination reveals a large mass which is typical of T.B. prostate. Sent to convalescence home.
3. J. L., No. 267216, 270006	24	T.B. epididymis (R), T.B. vasdeferens (R), T.B. S. vesiculectomy, T.B. perineum	Epididymectomy, partial vasectomy, S. vesiculectomy, resection of wound	Lamp treatment	Yes		Yes			Enlarged boggy prostate typical of T.B.
4. A. J., No. 262824	33	T.B. epididymitis, abscess spermatic cord	Epididymectomy (L), drainage of abscess	Lamp treatment	None		Yes			Gained weight. Much improved. Prostate much enlarged.
5. H. H., No. 285159	30	T.B. epididymes	Epididymectomy, bilateral	Lamp treatment	None		Yes			Large indurated prostate; seminal vesicles nodular.
6. A. T., No. 284718	28	T.B. epididymes	Epididymectomy, bilateral	Lamp treatment	None		Yes			Had eye-ball removed for T.B. Has T.B. of spine. Enlarged and indurated prostate.
7. E. O'D., No. 280179	25	T.B. epididymis (L), T.B. prostate and S. vesicles	Epididymectomy (L)	Lamp treatment	None					Enlarged and boggy prostate.
8. A. M., No. 275381	29	T.B. kidney (R), T.B. lungs	Nephrectomy (R)	Lamp, diet, hygienic	Yes		Yes			Prostate twice usual size. Very firm in consistency.
9. J. P., No. 285471	49	T.B. epididymis (L), pulmonary T.B.	Epididymectomy (L)	Lamp, diet, hygienic	Yes					Enlarged and boggy prostate.
10. E. G., No. 274641	30	T.B. kidney (R), T.B. epididymes	Nephrectomy (R)	Lamp, diet, hygienic	Yes					Has had pain in epididymes and has been receiving light treatment for same. Prostate enlarged and harder than normal in consistency.
11. C. F., No. 280486	15	T.B. epididymis (L)	Epididymectomy (L)	Lamp, diet, hygienic	Yes		Yes			Has an enlarged boggy prostate. Left vasa deferentia thickened and beaded.
12. P. E., No. 279744	41	T.B. epididymis (R)	Epididymectomy (R)	Lamp, diet, hygienic	Yes					Had orchidectomy two years ago for T.B. Prostate is enlarged and boggy. Seminal vesicle enlarged and tender.
13. F. DeC., No. 268306	38	T.B. kidney and ureter (R), epididymectomy	Nephrectomy and ureterectomy (R), epididymectomy	Lamp, diet, hygienic	Yes					Prostate enlarged and harder than normal.

Name and No.	Age	Diagnosis and method of investigation	Operative	Non-operative diet, rest, fresh air, Alpine light	Tuberculin	Results				
						Cured	Improved	Unimproved	Dead	Remarks
14. G. McN., No. 267444	69	Enlarged prostate operation	Two-stage prostatectomy	Diet	None		Yes			Sent to Sea View for after treatment.
15. S. G., No. 276016	53	Stones in prostate	Two-stage prostatectomy	Diet, Alpine light	None			Yes		Died at home 3 weeks after leaving
16. S. E., No. 241122	31	T.B. prostate	None	Rectal examination on this patient showed a typical T.B. prostate	None					Patient had T.B. of seminal vesicles and epididymes. Was not in condition for any kind of surgical intervention. Sent to the country.
17. Nos. 242056 249033 250609	28	T.B. epididymes, T.B. vesicles. Prostate on examination is typical of tuberculosis.	Epididymectomy, S. vesiculectomy	None	None					Patient had bilateral epididymectomy. Came back several months later; had a bilateral seminal vesiculectomy. At time of operation the rectum was injured and had a fæcal fistula. Unknown whether he had any treatment after he left.
18. G. W., No. 259623	20	T.B. S. vesicles, T.B. testicle	Vesiculectomy, bilateral, unilateral orchidectomy	Alpine light	None		Yes			Had perineal sinus. Prostate normal on examination. To go to country.
19. S. N., No. 254347	40	T.B. s. vesicle (R), vas (R), epididymis (R)	S. vesiculectomy, vasectomy, epididymectomy, all (R)	None	None		Yes			Patient had a typical T.B. prostate.
20. P. V., No. 217736	28	T.B. testicle, T.B. vas and spermatic cord and epididymis	Orchidectomy (this case was on Second Surgical Div.)	None	None		Yes			Returned a year after and had nephrectomy. No rectal done.
21. J. K., No. 255332	23	T.B. scrotum, T.B. vas deferens	Excision for T.B. (L) scrotum (Second Surg. Case)	None	None		Yes			Returned after he had epididymectomy one month ago for T.B. Rectal was negative.
22. A. deS., No. 271442	46	T.B. kidney (L), T.B. prostate, T.B. epididymes	Nephrectomy (L), epididymectomy, bilateral							Has been receiving our complete T.B. treatment, including diet, rest, tuberculin and light treatment. Has gained weight. Is in good condition.
23. No. 275782	25	T.B. epididymis (L), T.B. S. vesicle (L), T.B. prostate	Epididymectomy (L)	Diet, lamp, hygienic	Yes		Yes			Prostate enlarged to twice usual size. Nodular seminal vesicles enlarged.

the testicles. Seven of them had seminal vesiculitis in addition to their tuberculosis of the prostate gland. Kidneys, ureters and bladders were involved in five cases, while unmistakable tuberculosis of the lungs was present in two cases.

The two cases which on ordinary routine examination showed no other gross lesion of tuberculosis were as follows:

CASE REPORTS

CASE I.—Male, G. McN., age 69 years, history No. 267444. On admission, June 6, 1926, patient complained of frequent, difficult and painful urination. His past, personal and family histories were of no relative importance. The frequency of urination started about four years prior to admission and grew progressively worse. This gave him very little concern but about a week before he entered the hospital marked difficulty of urination and coincident pain developed. At no time had he noticed blood in his urine, which, he stated, was always very clear. The physical examination was negative save for the prostate which was enlarged three times its normal size and not nodular. There were six ounces of residual urine. A diagnosis of adenomatous hypertrophy of the prostate was made, and on June 8, 1929, a suprapubic cystostomy was performed and the prostate found to practically fill the bladder. On June 18, 1929, a perineal prostatectomy was performed with sacral and parasacral anæsthesia. The prostate was enucleated. This procedure was accomplished with difficulty because of the unusual softness of the gland, which was boggy and full of pus.

Convalescence was slow and despite all effort to close them, sinuses persisted in the abdominal and perineal wounds. Alpine lamp treatment was administered without result. Finally the patient was transferred to another institution and it has not been possible to ascertain the ultimate outcome of the case.

CASE II.—Male, S. G., age 53 years, history No. 276016, was admitted to the hospital December 23, 1928; chief complaints frequency, cloudy and bloody urine. For two years he had been treated intermittently for cystitis and frequency but no prostatic examination had been made nor had he been cystoscoped. His past, personal and family histories were essentially negative. He was emaciated and his prostate was enlarged and nodular. Upon pressure definite crepitus was elicited in these nodules, suggesting the presence of prostatic calculi.

The X-Ray showed the left kidney shadow large and low. Right kidney shadow not clearly made out. In the region behind the symphysis there were several shadows; again led to the inference that there were stones in the prostate. Cystoscopy was attempted but no information of value was gained because there was so much pus and debris that the ureters could not be located.

The patient's general condition improved under treatment and on December 30, 1927, with local anæsthesia, a suprapubic cystostomy was performed and drainage through the abdominal wound established. There was very little prostatic intrusion and no stones were palpable. On January 25, 1929, perineal prostatectomy was performed. The prostate was moderately enlarged and was enucleated with difficulty. It contained a small quantity of pus and some gravel. Several areas of caseation and calcification were noted. Microscopic section of the tissue removed presented the histological features of an advanced tuberculosis. At many places conglomerate tubercles were encountered in an advanced stage of central caseation. In addition sections showed the structure of a fibroadenomatous hypertrophy of the prostate.

Pathological Report.—Microscopically the contents of the tube with one piece in it shows fibrous tissue with necrotic areas, one area suggesting early calcification. The other material shows muscular and glandular tissue of prostate-like arrangement in which are found fairly typical tubercles, polygonal cells and somewhat atypical Langhans' cells, also areas of caseous necrosis.

Immediately following the prostatectomy the patient had a severe reaction with high temperature but gradually his condition improved. For a while the improvement continued but a cold abscess developed in the left elbow and in the right wrist. Ultra-violet ray therapy was instituted. A sinus formed in the abdominal wound and also in the perineal wound. The patient's general condition grew progressively worse and he died March 15, 1929.

Often cases that seem to be primary prove, on complete investigation, to be secondary to some remote lesion which has become inactive or arrested. As a matter of fact one cannot be absolutely certain that a case of tuberculosis of the prostate is primarily confined to that structure without an autopsy. Thus it is seen that this diagnosis is a very difficult one to make in an authoritative manner.

Tuberculosis of the prostate is most commonly found associated with acid-fast bacillary infections of the epididymes, vasa deferentia and seminal vesicles. Occasionally the epididymis, vas deferens, seminal vesicle and kidney on one side will be diseased and the other side will be entirely free. In such a case one may find tuberculous nodules and even abscess formation on the corresponding side of the prostate gland and the other side comparatively or entirely free from the disease.

One of the most surprising things in the practice of medicine is the immunity from infection that the prostate enjoys in certain cases suffering, sometimes for many years, from renal tuberculosis, during which time the posterior urethra and prostatic duct orifices are almost constantly bathed in tuberculous urine.

Operative Treatment.—Surgery is not ordinarily indicated in tuberculosis of the prostate and, indeed, in most cases in which the tuberculous prostate has been removed the operation was performed due to a mistake in diagnosis, as happened in one of our cases, No. 276016; or the tuberculosis accompanied some other pathological lesion such as case No. 267444, in which the tuberculous lesion occurred in an adenomatous hypertrophy of the prostate gland.

There are very few conditions in which surgical removal of a tuberculous prostate is indicated. Evacuation of a tuberculous abscess is to be avoided when possible, as such a procedure is liable to be followed by sinuses which heal slowly or not at all and may become a source of great annoyance.

Non-operative Treatment.—It is our practice to subject cases which have been operated upon as well as those upon whom operation is not done to a continual period of observation and care. In the clinic which we have established for this purpose and in fact for the treatment of all cases of post-operative and inoperable tuberculosis of the organs of the genital and urinary tracts, the patient's temperature is taken and recorded, the weight is observed. Instructions as to diet, exercise, rest, fresh air, sunlight and other hygienic measures are carefully explained and enforced as far as possible. In addition parallel series of cases are being observed, one group of which are given Alpine light or quartz light therapy and the other Koch's Old Tuberculin in graduated doses.

Tuberculin has been used by us for more than three years. It is not used alone but it is included in the régime of treatment as an adjunct or subsidiary agent. The régime comprises besides tuberculin, the hygienic, dietetic and rest treatment of tuberculosis, mercury vapor, quartz light therapy, heliotherapy and the indicated urologic treatment. The general plan is to combine the urologic treatment with the treatment of tuberculosis to the extent it is applicable, thus developing a régime of treatment which may be adapted to the needs of the individual patient. Those patients with active pulmonary tuberculosis in addition to their urologic lesions, are not given tuberculin.

The theory upon which tuberculin is given a place in the general plan of treatment is the present-day accepted theory that tuberculin causes an inflammatory focal reaction at the site of the disease and thus promotes fibrosis of the lesion. It is recognized that it is difficult to bring about unharmful focal reactions since the characteristics of the lesions vary so widely, particularly in renal tuberculosis. In the same renal lesion, young tubercles, old tubercles, small uncaseated tubercles and large pus-filled or fibrotic cavities frequently coëxist. It is evident that the effect of a given amount of tuberculin on the various lesions must vary widely. Therefore it has been deemed best to adhere to the plan of small dosage, relying on the appearance of any evidence of local, focal or constitutional reactions as the guide to the dosage. This method is of course open to criticism on the grounds that focal reactions are not always obtained when there is no subjective or objective evidence of them. However, the method seems to have worked out satisfactorily.

Koch's Old Tuberculin is the only tuberculin used. It was chosen for no particular reason except a somewhat more extensive experience in its use and it has been suggested that it causes more inflammatory changes at the focus of the disease.

Serial doses begun in small amounts are slowly increased until evidence of a local, focal or constitutional reaction occurs, then the dose is reduced and continued with a cautious increase until a reaction again occurs. It is again reduced and continued as before. The usual beginning dose is one-tenth c.c. of a one to ten million dilution of tuberculin. The injections are given subcutaneously.

The serial dilutions of tuberculin are prepared in the following manner which is at least in part widely used. Seven small wide-mouthed, glass-stoppered bottles, a graduated one c.c. glass pipette and a graduated ten c.c. glass pipette are sterilized. In one of the glass bottles one c.c. of Koch's Old Tuberculin is placed. To this is added nine c.c. of the diluent consisting of distilled water to which eight-tenths of one per cent. of sodium chloride and twenty-five-hundredths of one per cent. of phenol have been added and sterilized by autoclave. The bottle is labelled O.T. .1 and for convenience the date of the preparation is also placed on the label. The bottle is shaken vigorously by hand and one c.c. is withdrawn and placed in one of the remaining bottles. To this is added nine c.c. of the diluent and the bottle is labelled O.T. .01. After shaking, one c.c. is then withdrawn from this bottle

and the dilutions are carried on in the same manner through the remainder of the seven bottles. There are then seven bottles labelled as follows: O.T. .1; O.T. .01; O.T. .001; O.T. .0001; O.T. .00001; O.T. .000001; O.T. .0000001. The tuberculin is not designated in milligrams or grams as the above liquid measurements have been found practical for both estimating the individual patient dosage and for record keeping. The dilutions are kept in the refrigerator in the intervals between clinic sessions. Fresh dilutions are made about every two weeks during summer months and monthly during the winter. The diluent has been kept as long as a year with no evident deterioration.

Results of Treatment.—Twenty-one of these cases had an operation, only two of which were on the prostate gland. Of the latter, one died a few weeks after leaving the hospital. Another case improved under palliative treatment.

Eight of the cases were given tuberculin after the method practised by Wang and apparently benefited greatly by its administration. None of the patients were harmed by the tuberculin injections.*

REFERENCES

[1] Koll: Annals of Surgery, October, 1915.
[2] Barney: Jour. Urol., vol. x, July, 1923.
[3] Hesse: Cent. F. Die Grenzgebiete der Med. und Chir., vol. xvii, p. 361, 1913.
[4] Krzywicki: Beitr. z. Path., Anat. u.z. Allg. Path., vol. iii, pp. 295–334, 1888.
[5] Reclus: Thèse, Versailles, 1876.
[6] Simmonds: Deutsche Arch. f. Klin. Med., 1886.
[7] Collenet: Thèse de Paris, 1883.
[8] Halle et Motz: Ann. des Mal. des. Org. Gen. Urin., p. 502, 1903.
[9] Waller: Johns Hopkins Hosp. Repts., vol. xvi.
[10] Crandon: Boston Med. and Surg. Jour., vol. cxlii, p. 19, 1902.
[11] Wulff: Deutsche Med. Wchnschr., p. 1332, 1909.
[12] Burckhardt: Muench. Med. Wchnschr., p. 1750, 1911.
[13] Socin: Deutsche Chirurg., Lief 53, 44.
[14] Lowsley and Kirwin, Text Book of Urology, Lea and Febiger, 1926.
[15] Stanley L. Wang: Personal Communication.

* The authors wish to express their thanks to members of the staff of the New York Hospital who have allowed their cases to be used in this study.

TESTICULAR NEOPLASMS

THE RELATION BETWEEN THE PATHOLOGIC HISTOLOGY, CLINICAL COURSE, AND REACTION TO IRRADIATION IN TESTICULAR NEOPLASMS

By Benjamin S. Barringer, M.D.,
Fred W. Stewart, M.D.,
and
John W. Spies, M.D.,
of New York, N. Y.

From the Memorial Hospital, New York City

The advent of irradiation treatment of testicular neoplasms has greatly altered the prognosis of this disease. Whereas in former times the diagnosis of teratoma testis with metastases meant a uniformly lethal termination, it is becoming increasingly evident that with adequate irradiation certain types of highly malignant testicular neoplasms may be completely controlled even though demonstrable retroperitoneal metastases were present. It has been known for some time that various testicular tumors and their mestastases react quite differently to irradiation. In certain instances the primary tumors and their metastases disappear precipitately and do not recur within a period of years. In other cases the primary tumors react with varying promptness, usually do not recur, whereas the metastases react well, may completely disappear so far as palpation can detect, but recur after a varying interval. Still another group is quite radioresistant. Incidental observations from time to time have convinced us that a considerable degree of correlation exists between the pathologic histology, clinical course and radiosensitivity in this group of tumors and the present paper summarizes the results of a study of the available material in the endeavor to confirm or disprove the supposed correlation.

Up to approximately the end of 1928, 150 cases of testicular neoplasms had been observed in this hospital. In by far the majority of instances the primary tumor had been removed in some other institution where a diagnosis was made and from whence the patient was referred to the Memorial for irradiation treatment. In certain instances the primary tumor was never removed, the diagnosis resting on the conformation of the tumor, the presence of palpable metastases, and the reaction of one or both to irradiation. In forty-two of the 150 cases the testis was removed either before or after irradiation at this or at another hospital and the pathological examination made. The present report deals only with these forty-two cases verified in our own laboratory.

Some fifteen years ago the first patients with testicular tumors were irradiated at this hospital. It was a fortunate circumstance that the first few cases had tumors of the very radiosensitive, embryonal, anaplastic, carcinoma type, and the spectacular disappearance of the metastatic masses was sufficiently dramatic to force one to realize the importance of this revolu-

tionary change in the treatment of testicular teratoma. From that time on these tumors have been consistently handled by irradiation. Certain general principles rapidly became obvious. Surgery assumed an importance considerably below that of irradiation and its apparent value has so dwindled that it is a matter of discussion at the present time whether any surgical procedure at all should be carried out in these cases. We will consider this point later. Some tumors rapidly disappeared under irradiation, others were but slightly affected. Some metastases vanished only to reappear, indicating the necessity of increasing the irradiation in this group. In earlier years no method other than trial and error could be utilized. In time it became apparent that the reaction of the tumor mass to irradiation indicated to some degree the type of tumor. The anaplastic embryonal carcinomas diminished rapidly and often wholly disappeared, whereas tumors containing more differentiated structures tending toward the adult type frequently failed to react. The fact became gradually apparent that the highly malignant anaplastic carcinoma was actually less to be feared than its less malignant-appearing associates. When it became desirable to correlate tumor structure with clinical behavior, on the basis of experience both in this and in other tumor fields as to the histological diagnosis of probable radiosensitivity, the following working table was constructed. To test the validity of the suppositions made in the table we have examined the records of the forty-two cases above noted. As might be expected, not all the older charts contain conclusive statements as to the rate of regression under irradiation. There are enough cases in the two main tumor groups, anaplastic embryonal carcinoma, embryonal adenocarcinoma, to check the tabulation. The other groups have occurred too rarely to be of value in drawing conclusions.

In constructing this working table all of the slides on the various cases were reviewed. Unfortunately in the majority of instances the gross material is no longer available. Furthermore the destructive effects of radiation often reduce the testicular tumor to a necrotic, caseous mass, in which it may be very difficult to secure a region which gives much indication of the histology of the original tumor. Indeed in this hospital previously to the accumulation of sufficient experience in the microscopic appearance of radiated testicular tumors, the diagnosis of gumma has been made pathologically in cases behaving clinically like the very radiosensitive teratomas. The table is not intended as a classification of testicular tumors. It is a summary of the malignant types of proliferation found in the slides available from the forty-two cases studied. Of the forty-two cases at least thirty-eight would appear to belong in the embryonal group. Of the remainder, the three cases classified as carcinoma, adult type, tubule origin, considerable doubt must exist in the absence of complete study of the gross material especially as regards the location of the tumor in the testis. In no one of these three cases is the data sufficient to exclude a teratoid origin. Moreover in another case not included in the present material—a case which histologically very strongly suggested an origin of the tumor from tubule cells—the patient was a child of eight years,

an age certainly unusual for the development of cancer. Quite recently Desjardins, Squire and Morton [1] have once more concluded that the common embryonal carcinoma with lymphoid stroma is derived from adult spermatogonial cells, thus sharing the opinion of Chevassu [2] and others, of late Dew.[3] They base their conclusions on the common property of radiosensitivity of these tumors and of spermatogonial cells in the normal organ, at best a doubtful criterion especially since the authors make no effort to dispose of the evidence advanced by Wilms [4] and Ewing [5] for the teratoid origin of these types. In this connection it is of interest to note that the age distribution of "mixed, or teratoid tumors" and of "embryonal carcinoma" is quite similar

TABLE I

Reaction to Irradiation	Tumor type	Number of Cases
Radiosensitive	Embryonal carcinoma (diffuse tumors with very slight or no alveolar tendencies; embryonal carcinoma with lymphoid stroma)	24
	Lymphosarcoma	1
Moderately Radiosensitive	Embryonal adenocarcinoma and embryonal adenoma malignum (tumors with distinct gland-like cavities lined by cylindrical cells or with such gland-like cavities intermingled with areas of diffuse overgrowth)	10
	Embryonal myosarcoma (spindle-cell sarcomatous development in embryonal stroma, suggestive of muscle origin)	3
Radioresistant	Carcinoma, adult type, tubule origin (three cases of doubtful interpretation)	3
	Squamous carcinoma (developing in epidermal teratomatous structures)	1

(Chart I of the Desjardins, Squire and Morton). Quite recently Leroux and Hufnagel [6] have described another "seminoma" in which they demonstrated cartilage which latter they, influenced by Chevassu's interpretation of the seminoma, regard as a reactive metaplasia.

We may perhaps best deal with the material comprising this study under the following subdivisions: 1, the reaction of the primary tumor to radiation; 2, the behavior of the metastases; 3, the known length of time during which the primary tumor existed previous to the beginning of treatment; 4, the prognosis so far ascertained for different histologic types; 5, an analysis of certain failures.

When we attempt to analyze the available data on the reaction to irradiation in the anaplastic group of tumors we immediately meet with difficulties since of twenty-four histologically verified tumors of this variety, nineteen had been removed at some other institution previous to any irradiation treatment. The remaining five tumors diminished very rapidly in size follow-

ing irradiation and within a period of two to three weeks were reduced to one-third or less of their previous dimensions. In embryonal adenocarcinoma or embryonal adenoma malignum, tumors consisting of a teratoid glandular malignant proliferation with more or less well-defined glandular structures, of twelve verified cases, six entered the clinic after orchidectomy had been performed at another hospital. Of the remaining cases, three failed appreciably to diminish in size after treatment, one decreased but little, another decreased slightly, then after a stationary period of eight months, it increased in size; the sixth showed marked diminution, being reduced (in one week) to half its former dimensions. The lymphosarcoma reacted promptly and markedly to irradiation but subsequently terminated fatally in the usual manner of these tumors. The tumors classified as myosarcoma, squamous carcinoma in adult teratoma, and adult carcinoma were but slightly influenced by irradiation treatment. We may therefore conclude that the embryonal anaplastic carcinomas react like highly radiosensitive tumors, the embryonal adenocarcinomas with well-formed glandular structures are considerably less sensitive, and the other tumors in our collection are quite radioresistant. One might therefore be inclined to conclude that from the reaction of the primary testicular tumor some definite indication as to its type might be determined. This is true to a certain extent. Nevertheless certain other factors must necessarily enter into the matter, for in an adult cystic teratoma with embryonal elements capable of metastasizing, the irradiation may completely destroy the more active cellular portions and yet leave the adult structures relatively unaltered. One would therefore be misled into believing that the treatment was without effect, whereas as a matter of fact it had accomplished its purpose. In one other cellular tumor with many features justifying the diagnosis of choriocarcinoma testis the irradiation almost entirely destroyed the local tumor yet the testicular mass remained for several weeks unaltered. This lack of diminution in size was the result of thrombosis and infarction of the tumor vessels, practically converting the tumor mass into a hematoma, which of course did not diminish under irradiation.

The behavior of metastases toward irradiation is a complicated matter which, with our present material, is not clearly analyzable. Without autopsy or biopsy tissue from the retroperitoneal masses it is not possible to ascertain the exact structure of the metastases. Of course biopsy is wholly contraindicated. In complex teratomas one does not know which element or elements have metastasized. In embryonal adenocarcinomata one does not know whether the well-defined glandular form persists in the metastases or whether the latter are more anaplastic and hence more radiosensitive. Of the group of embryonal anaplastic carcinomas we have data in fifteen cases on the behavior of metastases. In one case only did the metastatic tumor fail to regress appreciably under treatment. In the remaining cases the metastatic masses showed marked or complete regression in from three weeks to ten months. Thus some disappeared in a spectacular fashion while others diminished much more slowly. In the more differentiated glandular teratoid adenocarcinomas

or malignant adenomas data is available in six instances. Four tumors reacted markedly to irradiation suggesting that they were perhaps more cellular and anaplastic than the primary tumors. In the two remaining cases the tumor metastases failed to regress.

Of twenty-four patients with embryonal anaplastic carcinomata, ten are clinically well. Of these cases four had metastases. In reporting these cases we are concerned only with the histologically verified cases, thereby leaving out many clinically undoubted tumors successfully treated but without pathological material for personal study. The metastases in the four cases above mentioned were in the following locations: right abdomen, right inguinal region and right abdomen, left hypochondrium, left upper abdomen. These cases are well—that is, free from demonstrable disease, two years and seven months, three years and eight months, three years and nine months, and ten years. Two verified cases of embryonal adenocarcinoma are clinically free from disease. Of these cases one had metastases in the right upper abdomen. This patient is clinically well four years and ten months.

The following case is of interest in demonstrating the enormous quantity of irradiation required to destroy these tumors and the uselessness of small dosages of X-ray or radium.

The patient was a negro chauffeur, aged thirty-seven years. He was admitted to the hospital in May, 1925, with a history of painless swelling of the right testis over a period of five months. The testis steadily increased in size and two weeks before admission first became painful. Three months prior to entering the hospital the patient began to cough and had frequent night sweats. He had lost thirty-six pounds in weight. Examination revealed a tumor of the right testis measuring fourteen centimetres in circumference. A mass 5 x 7 centimetres was palpated in the right abdomen and X-rays of the chest showed extensive pulmonary metastases. In addition there was a hard supraclavicular node measuring 1 x 2 centimetres. No operation was done. The patient was treated with a great deal of high voltage X-ray and with radium. The testis was reduced to a firm fibrotic mass. The metastases disappeared and the patient is now clinically well and free from demonstrable disease for four and a half years from the time treatment was first instituted. The skin shows pratically no effect from the treatment. The radiation employed in this case is charted in the following table.

TABLE II

Radium treatment

Date	Millicuries	Time	Millicurie hours	Filter	Distance	Location of treatment		Apparatus
10/ 6/26	1935	6 hrs. 10 min.	12000	2 mm. brass	10 cm.	Ant.	epig.	emanation pack
10/ 7/26	1844	4 hrs. 12 min.	8000	2 mm. brass	10 cm.	Ant.	epig.	emanation pack
8/25/27	4000	3 hrs.	12000	2 mm. br. 0.5 mm. pt.	15 cm.	L.U.Q.	post.	element pack
8/31/27	4000	3 hrs.	12000	2 mm. br. 0.5 mm. pt.	15 cm.	L.U.Q.	post.	element pack
9/ 5/27	4000	3 hrs.	12000	2 mm. br. 0.5 mm. pt.	15 cm.	L.U.Q.	ant.	element pack
9/10/27	4000	3 hrs. 15 min.	13000	2 mm. br. 0.5 mm. pt.	15 cm.	L.U.Q.	ant.	element pack
9/17/27	4000	2 hrs. 45 min.	11000	2 mm. br. 0.5 mm. pt.	15 cm.	L.U.Q.	post.	element pack
9/20/27	4000	3 hrs.	12000	2 mm. br. 0.5 mm. pt.	15 cm.	L.U.Q.	post.	element pack

X-Ray treatment

Date	Time	Milli-amps.	Filter	Sp. Gap	Focal dist.	Region treated
5/ 7/25	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium
5/ 8/25	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right lower abdomen
5/ 9/25	25 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right testis and cord
5/13/25	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right chest posterior
5/15/25	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Left chest posterior
5/18/25	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right chest anterior
5/19/25	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Left chest anterior
1/12/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right groin and testis
1/15/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right abdomen anterior
1/19/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right abdomen post.
1/20/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right chest posterior
1/25/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right chest anterior
1/27/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Left chest anterior
1/29/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Left chest posterior
4/ 2/26	25 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	L. Supraclavicular
5/24/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium, right
5/27/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Abdomen anterior
6/ 1/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium, right
6/ 1/26	60 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Abdomen, posterior
6/ 4/26	7 min. (water cooled tube)	20	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Right groin & scrotum
8/26/26	40 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Mediastinum, centre, ant.
8/28/26	14 min. (water cooled tube)	20	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	L. upper abdomen ant.
8/30/26	(water cooled tube)	20	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	L. upper abdomen post.
10/ 6/26	10 min.	20	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium posterior
10/ 8/26	7 min.	20	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium posterior
10/23/26	40 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium anterior
11/30/26	40 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Epigastrium anterior
12/30/26	40 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	L. abdomen oblique
1/ 4/27	40 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen oblique
1/15/27	40 min.	4	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	L. abdomen oblique
1/26/27	5 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen oblique
	(the last and all subsequent treatments with water cooled tube)					
2/ 4/27	5 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen,upper post.
2/11/27	5 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen, upper ant.
2/18/27	5 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen,upper post.
3/22/27	6 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen, upper ant.
3/22/27	10 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. scrotum and groin
3/26/27	6 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen, upper ant.
3/29/27	6 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. abdomen,upper post.
4/12/27	6 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	L. abdomen, upper post.
4/19/27	3 min.	30	0.5 mm. cu. 1.0 mm. al.	90	25 cm.	L. abdomen, upper ant.
4/26/27	6 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	Posterior mediastinum
5/ 3/27	10 min.	30	0.5 mm. cu. 1.0 mm. al.	90	50 cm.	R. groin and scrotum

Where irradiation has failed to control the tumors analysis has shown that the treatment has been insufficient. Indeed, during the past two years the quantity of irradiation received by these patients has been very nearly doubled. There are, of course, cases in whom the disease is so far advanced where metastases are enormous and patients are cachectic, and under such conditions sufficient treatment to control the tumors cannot be administered. These die before they can be sufficiently irradiated. One case autopsied within

the last few months may illustrate this situation. The patient, aged thirty-eight years, applied for treatment three and one-half years after removal of the primary tumor. A very large right abdominal metastasis melted away under treatment and the patient gained strength. However, he soon became worse and died only four months after admission. At autopsy the metastatic masses completely filled the abdominal cavity, infiltrated the diaphragm, extended up along the aortic and mediastinal nodes to the supraclavicular region. On the irradiated side the tumor was reduced to a spongy, hæmorrhagic, fibrinous reticulum with practically no tumor cells in evidence in sections, whereas on the side which had had no irradiation the tumor was very active. The size and distribution of the metastases in this case had not been suspected and the patient was inadequately irradiated. This tumor was of the highly radiosensitive type. The more radioresistant embryonal adenocarcinomas with distinct glandular formations will undoubtedly continue to from time to time defy successful irradiation treatment. In such cases the struggle becomes a contest between the amount of irradiation necessary to control the tumor and the quantity which can be withstood by the patient.

	Cases		Cases
9–12 months	1	4–5 years	3
1–1.5 years	5	5–6 years	3
1.5–2 years	9	6–7 years	2
2–2.5 years	6	7–8 years	0
2.5–3 years	2	8–9 years	2
3–4 years	6	9–10 years	1
		10 years	1

Much discussion has arisen relative to the propriety of removing the primary tumor after its irradiation. At this hospital it is the custom to perform an orchidectomy for the following reasons: (1) To determine the type of tumor and to thereby gain some information as to the probable prognosis and the probable amount of irradiation necessary. (2) To obviate the necessity of subsequent over-irradiation of the opposite testis. (3) To prevent a local recurrence in a possible adult teratoma where the presumption is that resumption of activity of more anaplastic portions may again occur. These last two reasons for orchidectomy are at present merely theoretical.

Strangely enough it appears quite impossible to ascertain from the history of the duration of the primary tumor any definite information as to its type. If the histories given by patients are correct then it would seem that tumors classified histologically and behaving clinically like embryonal anaplastic carcinomas may have been present for from three months to seven years. This is perhaps a valid argument for interpreting these tumors as a one-sided development of a complex teratoid tumor whose cellular portions have obliterated adult differentiated portions existing over a long period. On the other hand the history of development of the embryonal adenocarcinomas or embry-

onal malignant adenomas ranges from three months to one and one-half years. In other words the most radiosensitive tumors are not necessarily the most rapidly growing.

At the time this article is written we are able to present data on 113 patients treated and followed in this hospital. Of these 113 cases, forty-one are living and clinically free from disease. The above table indicates the time duration:

Of these 113 patients, thirteen were primary operable cases with no palpable metastases. Ten, or seventy-nine per cent., are alive and clinically free from disease. Sixteen were primary inoperable cases with demonstrable metastases. Four, or twenty-five per cent., are clinically well. Three were recurrent operable cases (local recurrences). Three, or 100 per cent., are clinically well. Eighty-one were recurrent cases with inoperable local recurrences and inoperable metastases. Twenty-four, or thirty per cent., are without evidence of disease.

REFERENCES

[1] Desjardins, Arthur U., Squire, Fay H., and Morton, Sylvanus A.: Am. J. Roentgenol., vol. xxii, p. 137, 1929.
[2] Chevassu, Maurice: Tumeurs du testicule. Thése, Paris, 1906.
[3] Dew, Harold; Malignant Disease of the Testicle. London: H. K. Lewis, 1925.
[4] Wilms: Beiträge z. path. Anat., vol. xix, p. 233, 1896.
[5] Ewing, J.: Surg., Gynec. & Obst., vol. xii, p. 240, 1911.
[6] Leroux, R., and Hufnagel, Mme.: Ann. d'Anat. Pathol., vol. iv, p. 786, 1927.

KAOLIN IN THE TREATMENT OF EXTERNAL GASTRO-INTESTINAL FISTULAS

FRANK CO TUI, M.D.
OF NEW YORK, N. Y.

THE types of fistulas considered in this report are the spontaneous gastric and duodenal fistulas and such artificial fistulas as ileostomy, cecostomy and sigmoidostomy.

It is generally known that the continual discharge from fistulas of the gastro-intestinal tract causes pathologic changes of the surrounding skin, varying from a mere redness for a short distance around the wound to an extensive raw-looking area. The degree of excoriation and digestion seems to bear a definite relation to the enzymatic activity of the fistulous portion of the gut, the intensity being greatest in fistulas of the upper digestive tract, less in those of the right half of the colon and least in those of the left half of the colon. In some cases of duodenal fistulas the entire abdominal wall may be involved, presenting a beefy surface with the recti muscles standing out raw and bare.

Of the artificial fistulas, ileostomy presents the most difficulties in management because of the inevitable digestion occurring around the stoma. In those cases in which the ileum is drawn out into the main incision and opened immediately, the digestion around the wound may be so marked as to lead to evisceration under the least strain. In cecostomies, digestion may be quite as severe as in ileostomy, and in sigmoidostomies, there is little or no excoriation unless diarrhœa occurs. But aside from the discomfort these lesions cause, they prolong the patient's stay in the hospital by postponing the closure of the artificial anus where a closure is intended.

The use of such preparations as vaseline, zinc oxide ointment and other oleaginous substances as a protective for the skin, although recommended by many authors, is not only futile but actually harmful. They make the wound "messy" and retain the discharge and thus promote further digestion. The discharge seems to have a malignant propensity to lift up the vaseline layer and to burrow under it to get to the underlying skin. The same objection applies to paraffine, parresine and collodion.

It is not generally known that kaolin, in addition to being an internal medicament for various gastro-intestinal disorders, is also of benefit when used as a dressing in these cases. The power of kaolin to inhibit enzymatic activity was demonstrated by Petersen [1] in 1917. He found that on mixing .2 gm. of kaolin with 7.5 c.c. of duodenal and upper jejunal contents the rate of proteolysis was reduced by about 20 per cent. This figure is not impressive at first sight, but when the relatively small quantity of kaolin is considered, its marked anti-enzymatic activity is at once apparent. Smith and Christensen,[2] in testing out different substances that would tend to inhibit enzymatic activity in the discharge from intestinal fistulas, found that kaolin and charcoal

were the most useful. Because of the objectionable color of charcoal, they preferred kaolin. They used sterile kaolin in the form of a paste made with glycerine. After applying the paste, they surrounded it with kaolin powder.

In the hope that the absorptive power of kaolin, as demonstrated by Petersen, might be beneficial in artificial ani around which there was digestion, we started using it in 1926. The results encouraged us to extend its use to high fistulas. Our experience covers thirty-one cases, which may be tabulated as follows:

Four, duodenal fistulas; five, ileostomy—through stab wounds; three, ileostomy in main wound (infants with atresia of colon); four, cecostomy; fifteen, sigmoidostomy. We prefer the powder form as being simpler, more soothing and more absorbent for moisture. It is not necessary to sterilize it. Hektoen and Rappaport [3] and Rappaport [4] showed that when properly applied in a dry powder, kaolin removed not only diphtheria bacilli but practically all bacteria of the nose in the course of three or four days. It must be cautioned that crude kaolin is moist and lumpy and has less adsorptive power than the thoroughly dried and powdered product. At present, however, the commercial houses put out a very high grade of product so that one does not have to resort to drying and powdering and sieving it, as Rappaport had to do. Kaolin should not be used in the small amounts in which the ordinary dusting powder is used, but literally be heaped around the opening and over it. The caking that occurs does not offer any impediment to the free flow of the discharge. Immediately upon application the smarting and burning stop. The angry appearance of the part is soon lost and healing takes place rapidly.

In the treatment of the high fistulas, oil tampons [5] and irrigation with sterile water have been tried with unconvincing results. The use of atropine and sodium fluoride to inhibit the secretions is of little value.[6] Johansen [7] injected 1 per cent. citric acid into the fistula and reported favorable results in two cases, and recently Potter [9] has advocated the treatment of the various external intestinal fistulas with beef juice and dilute hydrochloric acid. The removal of the discharge by aspiration was advocated by Jones and Williams.[8] Erdman,[10] in 1921, devised a continuous suction pump which proved successful in the healing of a traumatic duodenal fistula. Cameron [11] reported a favorable result with the use of his electric pump, and Lahey [12] two cases in which the use of his continuous water suction pump resulted in prompt healing. In our four cases of high fistulas we have obtained excellent results by the use of this method of continuous suction with a liberal application of kaolin powder around the wound. The kaolin powder prevented digestion from an overflow of the discharge and hastened the healing of the digested areas.

In our five cases of ileostomy in which the ileum was drawn out through a stab wound, little or no irritation was encountered. In the three cases of infants, on whom, because of the critical condition of the patients, the ileum was brought out into the lower corner of the main wound and opened immediately, two had a slight infection and one had a severe infection, but digestion was controlled and evisceration was prevented. When one considers that

a large majority of these patients die as a result of evisceration the prevention of this almost always fatal complication in three consecutive cases was extremely gratifying.

The same good result was duplicated in our four cases of cecostomy and fifteen cases of sigmoidostomy. The powder was applied as soon as the externalized knuckle of bowel was opened. A slight reddening of the skin was found in one case of cecostomy. This was due to the use of kaolin in insufficient amounts and was soon remedied when liberal quantities were applied. In the fifteen cases of sigmoidostomy no irritation occurred. In one case in which the artificial anus was made immediately in the operative wound, and in which an infection was thought inevitable, we had the pleasure of seeing the wound heal by primary union. In all these cases of artificial anus kaolin undoubtedly shortened the patients' hospital stay at least two weeks.

SUMMARY

1. Kaolin is recommended as a dressing in cases of external gastro-intestinal fistula.
2. It need not be made into a paste. The powder is simpler, more soothing and more absorbent and adsorptive. It is not necessary to sterilize it.
3. It should not be used in the quantities of an ordinary dusting powder, but liberally applied.
4. It prevents irritation and digestion of the wound by the discharge, relieves burning and smarting and insures prompt and uninterrupted healing.
5. The use of vaseline and other oleaginous substances is harmful.

BIBLIOGRAPHY

[1] Petersen, W. F.: A Note on the Intestinal Action of Various Adsorptive Agents. J. A. M. A., vol. lxviii, p. 1234, April 28, 1917.

[2] Smith, A. J., and Christensen, H. H.: Intestinal Fistula, a Method of Preventing Skin Excoriation. Surg., Gyn. and Obst., vol. xliii, p. 701, 1926.

[3] Hektoen, L., and Rappaport, B.: The Use of Kaolin to Remove Bacteria from the Nose and Throat. J. A. M. A., vol. lxiv, p. 1985, June 12, 1915.

[4] Rappaport, B.: The Use of Kaolin to Remove Diphtheria Bacilli from the Nose and Throat. J. A. M. A., vol. lxvi, p. 943, March 25, 1916.

[5] Stadler, E.: Oil Tampon for High Intestinal Fistula. Schweiz. med. Wchnschr., vol. li, p. 978, October 20, 1921.

[6] Colp, R.: External Duodenal Fistula. ANNALS OF SURGERY, vol. lxxviii, p. 725, 1923.

[7] Johansen, N. A.: Duodenal Fistula: Its Treatment. Northwest Med., vol. xxvi, p. 56, 1927.

[8] Jones and Williams quoted by Cheever, D.: Concerning Traumatic Rupture of the Duodenum and Duodenal Fistula. Boston M. & S. J., vol. clxxiii, p. 454, 1915.

[9] Potter, Caryl: Treatment of Duodenal Fistula. J. A. M. A., vol. lxxxviii, p. 899, March 19, 1927; Treatment of Duodenal and Fecal Fistula. J. A. M. A., vol. xcii, p. 359, February 2, 1929.

[10] Erdman, S.: Transactions of the New York Surgical Society. ANNALS OF SURGERY, vol. lxxiii, p. 793, 1921.

[11] Cameron, A. L.: Treatment of Duodenal Fistula, Report of a Case. Surg., Gyn. and Obst., vol. xxxvii, p. 1599, November, 1923.

[12] Lahey, F. H.: Treatment of Duodenal Fistula by Suction. Surg. Clinics N. Am., vol. iv, p. 1489, December, 1924.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD NOVEMBER 13, 1929

THE PRESIDENT, DR. EDWIN BEER, IN THE CHAIR

RESECTION OF COSTAL ARCH FOR TUBERCULOSIS

DR. CARL EGGERS presented a man, 69 years old, who was admitted to the Lenox Hill Hospital February 28, 1927, on account of a discharging sinus over the right lower chest. About five months before that time, in September, 1926, he had noticed a small lump over one of the lower ribs on the right side. It had gradually increased in size and had been tender to touch. Two months after onset there had been a spontaneous perforation with discharge of pus. In spite of medical treatment drainage had continued. There was no other complaint. No cough. No constitutional symptoms except weakness.

The patient was quite anæmic, but looked well preserved for his age. He had several carious teeth, but no other focus of infection. He had a mitral regurgitation and a bilateral direct inguinal hernia. Examination of the lungs was negative.

Over the region of the right costal arch there was a swelling with a sinus tract which gave the appearance of being a chronic lesion. The swelling was flattened and about two inches in diameter. At the apex of this swelling, and close to the junction of the cartilages with the sternum, there was a sinus tract in an ulcerated area about one inch in diameter and having overhanging edges. It discharged sero purulent material. The ulcerated area was adherent to the underlying tissues. A probe could be inserted one and a half inches and seemed to pass inward between the cartilages of the seventh and eighth ribs to a deeper focus. No connection with an intrathoracic focus could be made out. A diagnosis of suppurative chondritis was made. During the next few days the temperature reached 101 every evening. There was no cough or sputum. Wassermann examination was negative. Röntgen-ray examination of the chest showed the bronchial tree somewhat intensified, but there was no evidence of pulmonary tuberculosis. The involved costal cartilages could not be demonstrated.

March 3, 1927, under local one-half per cent. novocain anæsthesia, an incision was made along the margin of the right costal arch and surrounding the sinus tract. The skin muscle flap was retracted, exposing all the cartilages. The suppurative process involved several of the cartilages and had partly destroyed them. The remaining portions were yellow and brittle. A radical operation was done, removing the entire affected costal arch and a small portion of three ribs, apparently the eighth, ninth and tenth, as well as a narrow margin of sternal border. Split tube drains were inserted and the flap was partly sutured back into place.

Culture of the deeper portions of the wound showed hæmolytic streptococci, while the pathological examination showed granuloma, probably tuberculous. Suppuration continued in the wound and the patient was discharged five weeks after operation, unhealed. On account of a persistent

sinus he had to be readmitted June 1, 1927. The wound was reopened at the sternal end as well as at the costal end. Necrotic cartilage was found representing apparently the cartilages of the sixth and seventh ribs. They were completely removed together with a small portion of each rib and of the sternal border. The eleventh rib with its cartilage was visible and palpable, but apparently not involved. The wound was thoroughly curetted and packed with iodoform gauze. Convalescence was uneventful. The wounds healed promptly and the patient was discharged cured two weeks after admission. He has had no further trouble.

EXERESIS OF PHRENIC NERVE FOR PULMONARY TUBERCULOSIS

DOCTOR EGGERS presented a young man, sixteen years old, who was referred to the surgical service of the Lenox Hill Hospital, October 16, 1929, for exeresis of the phrenic nerve and possibly an extropleural thoracoplasty. He had a well advanced pulmonary tuberculosis of four years' duration, affecting the entire left lung. The disease started with a pleural effusion, and later gave rise to cough with expectoration containing tubercle bacilli. He was treated at the New Jersey State Sanatorium for Tuberculosis for eighteen months and improved a great deal during this time. Ten months ago he developed influenza with a temperature of 102. Since that time he has gradually lost weight and strength, and cough and expectoration have increased. About six weeks ago he had hemoptysis for an entire day, followed by rusty sputum for a week. For two weeks prior to admission attempts had been made to induce a pneumothorax, but they had not been successful.

On admission the boy was anæmic looking and weighed 93 pounds. He ran a slight temperature up to 100.2 with a pulse of 90. He coughed very little, but the sputum was positive for tuberculosis. Examination of the chest showed extensive involvement of the left lung with retraction and diminished expansion of that side and displacement of the heart to the left.

Röntgen examination verified this finding. The right lung was reported clear, while the left showed chronic pulmonary tuberculosis with cavitation. In addition to the pulmonary involvement the patient has a cardiac lesion. At first it seemed to be of an organic nature, but careful study by means of the electro-cardiograph has established it to be a neurosis. There are, no doubt, extensive adhesions between the pericardium and the pleura, but apparently no intrapericardial adhesions.

With the failure of pneumothorax treatment on account of intrapleural adhesions surgery was definitely indicated in this boy. The Röntgen picture shows that nature has done all it can do to bring about contraction and fibrosis of the affected lung. The chest wall is retracted and less mobile than normally and the mediastinum has been displaced towards the affected side. In spite of that the process is advancing and hemoptysis recently took place. An exeresis of the phrenic nerve was decided upon, to be followed by renewed attempts at induction of a pneumothorax. More radical operation carried a considerable risk in this case on account of the condition of the heart.

The operation was performed October 19, 1929, under local one-half per cent. novocain infiltration. A three-inch incision was made above the left clavicle and parallel to it. The phrenic nerve was exposed without difficulty. Pinching it elicited pain in the left shoulder. The nerve was injected with novocain, grasped with a forceps and divided. It was then gradually twisted around the forceps and drawn out of the thorax. This caused considerable pain in the diaphragm on that side. About five inches of the nerve were removed. The wound healed *per primam*.

A Röntgen examination a few days later showed the diaphragm to have risen the distance of one rib and one intercostal space and to be motionless. The patient is shown to demonstrate the actual gain in diminution of the thoracic cavity obtained by exeresis of the phrenic nerve.

Should attempts at induction of a pneumothorax be unsuccessful, it is expected to perform an extrapleural thoracoplasty in several stages.

EXTRAPLEURAL THORACOPLASTY FOR PULMONARY TUBERCULOSIS

Doctor Eggers presented a woman, thirty-six years old, who was admitted to the surgical service of the Lenox Hill Hospital, May 20, 1926, for the purpose of having an extrapleural thoracoplasty performed. She had been under treatment at different clinics in New York for the past fifteen years, but had never been confined to a sanitarium. She had done her own housework and taken whatever hygienic measures she could. Every summer she had managed to spend considerable time in the country. During the last year she had been getting worse; she complained of vomiting a great deal which made her afraid to take food. She had night sweats and had run a moderate afternoon temperature. Her cough had become almost continuous and productive of large amounts of greenish expectoration. During the last two weeks the sputum had been blood tinged. She was bedridden and steadily losing ground. She had lost eleven pounds in the last three months. Her best weight had been one hundred and fifteen pounds a year before. Pneumothorax treatment had not been successful. There was nothing else in the past history of any importance, nor were there symptoms of disease referable to other organs. She was married and had three healthy children who had never shown signs or symptoms of pulmonary disease. One brother and one sister had died of pulmonary tuberculosis thirteen and twenty years before, respectively.

Examination showed a frail, almost emaciated, middle-aged woman, who coughed continuously. There was evidence of extensive pulmonary involvement on the left side with some retraction of the thoracic wall and diminished expansion. There was also dullness associated with rales and bronchovesicular breathing over the right apex. The heart action was good, the temperature 100.2, and the pulse ranged from 90 to 110. Her weight was 95 pounds.

While under observation during the following week the highest temperature was 101, highest pulse rate 116, and respiration was 28. Repeated sputum examinations showed tubercle bacilli. The blood count showed seventy-eight per cent. hæmoglobin, 3,900,000 red blood cells, 7,600 white blood cells, fifty-six per cent. polymorphs, two per cent. large lymph., forty-two per cent. small lymph. Röntgen examination of the chest showed the heart to be moderate in size and definitely drawn over towards the left. Practically the whole left chest showed an active tuberculous involvement with evidence of at least two large cavities. There was also evidence of involvement of the right apex.

With the coöperation of the Tuberculosis Department an operation was decided on, to be divided into three stages; the first, exeresis of the phrenic nerve; second, resection of the lower ribs; third, resection of the upper ribs.

The first operation was done May 27, 1926. Under local one-half per cent. novocain anæsthesia a two-inch incision was made above the left clavicle and parallel to it. The phrenic nerve was easily exposed. Pinching it caused pain in the anterior part of the left shoulder, just below the outer end of the clavicle. The nerve was therefore injected with novocain and divided. It was caught with a forceps and by a twisting motion was gradually

drawn out. This caused severe pain in the left upper abdomen, and while the nerve was being withdrawn, the patient repeatedly complained, "Oh my heart." There was, however, no change in her pulse and her color remained good. Withdrawal was continued until what looked like the entire nerve had been removed. It was ten or twelve inches long. The wound was closed with silk. It healed by primary union and an X-ray taken subsequently showed the diaphragm to have risen about one rib and one intercostal space. The patient developed fever up to 104, attributed to increased activity in the lungs, but this was not considered a contra-indication to further operation. As a matter of fact the tuberculosis department urged that we proceed with the treatment.

The second operation was performed June 9, 1926. Under local one-half per cent. novocain anæsthesia an incision was made along the course of the ninth rib and then upward posteriorly over the eighth, seventh, sixth and fifth ribs. The flap so outlined was retracted upward and forward carrying the scapula along. About four inches of the ninth, eighth, seventh, sixth and fifth ribs were resected subperiosteally. The parietal pleura was found to be very thin and a small perforation was accidentally made in the ninth and in the sixth interspaces. Both openings were immediately closed by means of a few plain catgut sutures and seemed to cause no difficulty. The wound was closed without drainage, using interrupted chromic catgut for the muscles and continuous plain catgut for the skin. The patient stood the operation well. She reacted nicely from it and the temperature gradually came down until the highest evening rise was 99.6. She began to feel better and stated that the cough was decidedly less. A small marginal necrosis developed along the incision and somewhat delayed the last stage of the operation which was performed June 26, 1926. On account of the greater difficulty in gaining access to the upper ribs this operation was done under gas oxygen anæsthesia. The original incision was extended upward almost to the clavicle. The muscles were divided and the ribs exposed. About three inches of the fourth and third ribs, two inches of the second, and one and a half inch of the first rib were removed.

The wound was closed without drainage and healed by primary union. There was only slight reaction, the highest temperature reaching 100.6. Within a few days it was practically normal, only occasionally going up to 100. The patient was encouraged to be out of bed early, to carry herself erect and to breathe quietly and deeply. She made an uneventful recovery, but lost weight during her stay in the hospital, from 95 down to 88 pounds. She was discharged July 13, 1926, seventeen days after her last operation, and fifty-four days after admission. She then carried herself well, her shoulders were of equal height, the function of her left arm was good, and except for loss of weight she was decidedly improved. A Röntgen examination at this time showed complete collapse of the left side of the chest with no lung tissue visible. Such a finding is considered the desired result.

Since that time the patient has remained under observation. She is far from well, but is able to do her own housework. The present symptoms are probably due to the involved right upper lobe.

This patient was pronounced hopeless by the tuberculosis department before operation. She had been bedridden of late and was steadily losing ground. The continuous cough was exhausting her strength and unless one could put the left lung with its cavities at rest by collapsing it, the prognosis was bad. Pneumothorax treatment had not been successful and operation was therefore decided on in spite of the involvement of the right upper lobe.

THORACOPLASTY FOR CHRONIC TUBERCULOUS EMPYEMA

Doctor Eggers presented a woman twenty-four years old, who was admitted to the Lenox Hill Hospital October 25, 1921, on account of a discharging sinus of the right side of the thorax. She gave the following history: She had been well until the birth of her child two years before. Three days after confinement she had a chill and fever and developed pneumonia which was followed by a pleuritic exudate. A rib resection was done and open drainage established. The fluid is said to have been watery in character and not like pus. She was treated at the hospital for three months and then transferred to a tuberculosis sanitarium where she remained nine months. During most of this time she ran a temperature up to 105 and 106. At first she had been treated with simple drainage, later by the Dakin Carrel Method. For the past year she had been treated at home, chiefly by her husband who irrigated the cavity every evening with boric acid solution and who stated that the capacity had diminished from seven to two ounces. He also stated that tubercle bacilli had been found in his wife's sputum on one occasion.

On admission the patient complained chiefly of dyspnœa and profuse discharge from her wound. There was no cough. She was a frail, anæmic, young woman, who looked chronically ill and who had flushed cheeks. She weighed 90 pounds. The temperature was 99.4, and the pulse 102. Examination of the chest showed the right side flattened and expansion diminished. There was a scar posteriorly in the region of the ninth rib and at this place a sinus led into the thorax and discharged pus. A probe could be inserted its full length, and on account of this open thorax the physical signs on that side were difficult to interpret. Over the left side the breath sounds were emphysematous in character, and at the apex there were signs suggestive of tuberculosis. The heart was rapid; there was no displacement or enlargement made out.

On the basis of the history and findings a diagnosis of chronic empyema was made, probably of tuberculous origin and associated with pulmonary tuberculosis.

The patient was put on a high caloric diet, rest in bed, and Dakin-Carrel treatment in order to clean up the infected cavity preparatory to whatever operation might be contemplated.

During this period of treatment she was carefully studied. Her temperature reached 99.4 or 99.6 in the evening, and the pulse did not go above 100. The Wassermann was negative. The urine showed a faint trace of albumin, but was otherwise negative. There was no cough or expectoration. Examination of the discharge from the sinus showed streptococci and tubercle bacilli. Her skin reaction was positive for tuberculosis. Röntgen-ray examination after injection of the empyema cavity showed it to extend from the sinus in the ninth rib to above the sixth rib. There was a focus in the left apex suspicious of tuberculosis.

The question arose how best to treat this condition. To continue irrigations in the face of unsuccessful treatment by that method for two years did not seem logical. Nature had already collapsed the lung as far as it was able to within the rigid thorax. By an operation one could expect to mobilize the chest wall and allow it to come into contact with the collapsed lung and at the same time to remove the affected lining membrane of the cavity.

The first operation was performed under chloroform oxygen anæsthesia, November 14, 1921, and consisted of resection of a portion of the tenth, ninth, eighth, seventh, sixth and fifth ribs. The intercostal vessels were

ligated and the muscles removed. The entire outer wall of the cavity was then removed. It was a half inch thick. A large flat cavity was exposed having a projection downward and forward along the costophrenic sinus and one upward posteriorly. The former was completely shelled out, liberating lung and diaphragm at that point. It was not thought wise to proceed further at this time, the cavity was packed with iodoform tampons and the muscles and skin were partly sutured. The convalescence was uneventful. No cough developed, and practically no increase in pulse or temperature.

The wound and tampons were not disturbed until the second operation, twelve days later, November 26, 1921. Upon reopening the wound it was found to be clean and without odor, and there was no retention of pus. A decortication of the lung was attempted, but could only be done incompletely in parts on account of the firm connection with the underlying lung tissue. Efforts were principally directed towards removing the thick layer of scar tissue at the angle of reflection of the pleura. In the attempt to separate the lung from the diaphragm the latter was accidentally incised for a distance of two inches. This slit was at once sutured with chromic catgut and subsequently did not give rise to trouble. In order to reach the upper part of the cavity and to make it possible for the chest wall to collapse three inches of the fourth rib and one inch of the third rib were resected. The intercostal muscles were not removed, but simply forced down into the cavity after the thickened pleura had been removed. An iodoform gauze tampon was placed to the oozing surface at the pleural reflection, while plain gauze tampons were used for packing the cavity. Another plain gauze tampon was placed under the scapula external to the intercostal muscles to favor collapse. The muscles and skin were partly closed. A week after the operation the tampons were removed under gas anæsthesia and two drainage tubes inserted.

After this second operation the course was somewhat more stormy than after the first. There were at times periods of fever up to 102 or even 103, but on the whole there was steady improvement to be noticed. The discharge gradually diminished, but did not cease entirely and the patient was discharge with a small sinus February 26, 1922. She had no cough, and no fever, and had gained four pounds in weight.

The pathological examination of the thickened pleural tissue removed at both operations showed tuberculosis.

The sinus healed after several months and she continued to gain in weight and strength. Now, eight years after operation, she considers herself well. She became pregnant at the end of 1922, but had it interrupted on our advice. In 1924 she went through a normal pregnancy.

It is of interest to report that the child which was born just before the onset of the pulmonary condition developed tuberculosis of the spine when about two years old. He was treated on a frame for a while and later had a bone graft inserted into his spinal column with a satisfactory result. The child is reported cured by his attending orthopedic surgeon.

TUBERCULOSIS OF LUNG. TENSE PYOTHORAX.

Dr. Howard Lilienthal presented a man, aged about twenty-eight, who came to him February 11, 1925. There had been a rapidly progressive tuberculosis with a number of hæmorrhages, the disease being confined chiefly to the right lung. Doctor Edgar Mayer, of Saranac, had employed artificial pneumothorax one year before. Refills were carried out for some months when a spontaneous pneumothorax occurred with great dyspnœa, fever and pain. Clear pleural fluid gradually became purulent and foul. When first

seen his chest was about three-quarters full of fluid and the lung was apparently well compressed. The temperature ran to more than 104 in spite of repeated aspirations, but although there was cough, there was no purulent expectoration. Respirations were 38; pulse as high as 134; heart apparently toxic. A mild intestinal tuberculosis had been diagnosed at Saranac, and there was irregular, abdominal distention. The heart was displaced far to the left. There was great emaciation.

FIG. 1.—Thoracoplasty to obliterate tuberculous empyema. Lipiodol injection shows syphon-like pocket. Note tube extending above into empty pleural space. Case of man age 28 years.

The first procedure was thoracotomy in local anæsthesia, with resection of the eighth rib including its periosteum. Three quarts of foul pus by actual measure were removed without spilling. There was immediate improvement under Carrel-Dakin treatment, but the affected lung showed no tendency to expand.

February 26, 1926, the upper nine ribs were resected by the paravertebral route. About three weeks later the capacity of the pleural sac was found to be 210 cubic centimetres and a revision of the thoracoplasty was performed. At this time further sections of some of the ribs were taken away, although forty-one inches of bone had been the total at the first operation. Four inches of the tenth rib were also resected by an incision parallel with the bone.

He was discharged from the hospital about two months after his first operation, but with the warning that further surgical procedures would be necessary to close the wound. In about two months he came back and at this time digital examination through the wound, and also X-ray pictures revealed a complicated condition of pocketing upward, downward and forward. (Fig. 1.) The tissues were almost cartilagenous in texture, so that at the operation which was then performed, the division had to be made with Liston's bone forceps. The entire wound was now left open.

FIG. 2.—The wound is completely healed and the elastic ahesive plaster is worn for temporary support only. It has since been discarded. Beginning alopecia areata. Case of man age 28 years.

After nearly two years, although the cavity contained less than forty cubic centimetres, drainage was still imperfect and again he was subject to operation; this time the entire pleural area was exposed to the eye. Although this was followed by improvement with contraction of the main cavity, two more revisions were required to expose and drain residual pockets

which had formed. But at last all raw surfaces were covered by epithelium and in December, 1928, the wound was definitely healed. No small credit is due to the employment of iodoform and ether for the purpose of disinfecting the pockets which seemed continually to reform. From the beginning of the employment of this remedy there was steady improvement in the quantity and character of the discharge and in the formation of epithelium covering. The reporter said that he had since made use of this solution in similar cases with much gratification. Ether and iodoform is more penetrating than the glycerine suspension of the same drug. Of course, one must be certain that there is no important bronchial connection with any cavity in which this solution is employed.

The patient is now apparently well. He is working regularly and leads a normal life. About a year ago alopecia areata appeared and the hairline condition is now general. Its cause is unknown.

TUBERCULOSIS OF THE LUNGS. PARAVERTEBRAL THORACOPLASTY.

DOCTOR LILIENTHAL presented a girl, aged sixteen years, who was sent to him November 5, 1928. For a year and a half she had had cough with positive expectoration. For seven months artificial pneumothorax had been employed; then adhesions occurred and fluid exudate appeared. There had

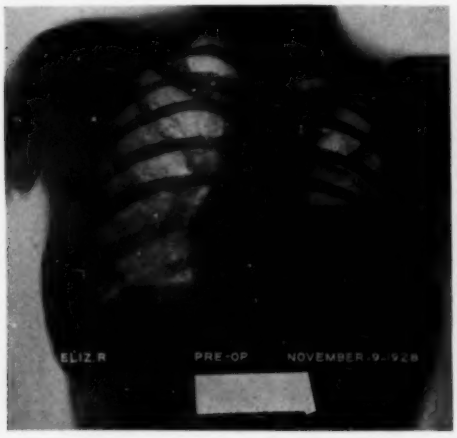

FIG. 3.—Case of a young girl. Tuberculous left pyopneumothorax preoperative.

FIG. 4.—Same patient as Fig. 3. Post-operative, Bucky's Diaphragm.

never been hemoptysis. She was well nourished. Blood pressure was 110 over 65. Vital capacity 1.2. Weight 118 pounds. X-ray pictures demonstrated a fibrocavernous left lung with retraction of the mediastinum and diaphragm, and a large amount of pleural air and fluid. Thoracoplasty was advised preceded by phrenic neurectomy.

On November 17, 1928, the reporter operated at Mt. Sinai Hospital. For the first time in his experience he failed to find the phrenic nerve, although an extensive dissection was made even to the separation of the fibres of the anterior scalene muscle. November 27, 1928, the upper six ribs were resected. A silk thread marker was placed around the seventh rib to be used for orientation at the time of the second stage operation. This was done December 3, 1928, in local anæsthesia, supplemented by a very little nitrous oxide and oxygen. The seventh, eighth and ninth ribs were resected, about three to four inches being removed subperiosteally. After this operation, although the patient did well, the fluid and air within the chest prevented

a satisfactory collapse. It was difficult to reach either air or fluid with an ordinary needle of large size, but the next day, by inverting the patient and turning her upon the diseased side, it was able to aspirate about ten ounces of thick pus through a puncture just below the axilla. The patient then went home to come to the hospital as an ambulant patient. There again, the patient lying upon the *right* (well) side, in slight Trendelenburg posture, a tiny incision was made in the axillary line at a level just above the nipple and the air chamber was entered with an aspirating needle. It was then possible to insert a small trocar and canula, and the patient was turned so that this puncture was lowermost. Six ounces of moderately thick pus were aspired with natural air replacement. Examination by the bacteriological department of the laboratory showed the presence of pneumococcus. About 1 dram of one per cent. mercurochrome was injected and the canula, previously filled with alcohol to prevent chest wall abscess, was removed. At this time there seemed to be an extension into the opposite lung and the prognosis was

FIG. 5.—A phrenic neurectomy. Operative scar had to be drawn in by photographer; it did not show on the film. Same patient as Fig. 3.

FIG. 6.—Same patient as Fig. 3. Showing scar of thoracoplasty and function of arms.

not favorable, but with repeated aspirations by her attending physician, Doctor Blowstein, the condition improved both clinically and on physical examination; so that when she reported November 7, 1929, she was apparently convalescent. Although there is sputum in the morning (about 8 cubic centimetres) there is no fever and no cough. She has gained in weight and superficially she seems healthy. Vital capacity 1.6.

The favorable immediate result in a case of this kind, the patient in early youth with apparent extension to the opposite lung after the thoracoplasty, is most unusual and gratifying. It is also remarkable that the pyopeumothorax has disappeared. X-ray pictures now seem to show an elongated area of moderate size which resembles a cavity, but since there is almost no expectoration there may be another interpretation of this rarefaction shown in the film.

DOCTOR LILIENTHAL presented also a man, now thirty-eight years old, who came under observation as an emergency situation April 7, 1928. He had been suffering from pulmonary tuberculosis for about fifteen years. Pneumothorax

therapy left lung was begun about thirteen years ago. He did very well under this treatment and was apparently cured of the tuberculosis. About three years ago the first evidence of a purulent effusion in the left chest appeared. Treatment by aspiration was employed. An abscess developed over the left posterior chest. This was incised and the sinus drained profusely for several months. About six months before the patient first came under the reporter's observation there was the onset of irregular fever with profuse, foul, purulent expectoration. These manifestations continued with remissions until three weeks before his hospital admission. Since then the clinical course has been rapidly downhill, with severe pain in the left chest on coughing; profuse, foul expectoration; high, irregular fever; and rapid emaciation.

On physical examination the striking features were the anxious expression, pronounced pallor, and septic appearance. There was obvious emaciation. The left chest was narrow as compared with the right, was completely flat on percussion, and breath sounds were faint. There was a sinus over the posterior aspect of the left lower chest into which lipiodol was introduced. The X-ray plate of the chest revealed a collection of fluid filling almost the entire left lower cavity. It presented a horizontal level situated at the second interspace anteriorly. Above the fluid level there was a collection of air. The collapsed lung could not be identified. The heart was greatly displaced to the right.

Operation was done under gas, oxygen anæsthesia. A free incision was made through the sinus over the left posterior chest and carried upwards to the level of the third rib. Long sections of the third to ninth ribs were removed together with intercostal tissues and the greatly thickened, fibrous parietal membrane over the empyema. An enormous quantity of exceedingly foul-smelling pus was evacuated. The lung was found crowded up to the apex and its surface was covered by the same, thick, necrotic membrane that lined the remainder of the pleural cavity. The purpose of this wide resection of the chest wall posteriorly was to open up to its fullest limits the pleural infection assumed to be complicated by contamination with an anærobic organism. The parietal membrane was excised for freer drainage and in the hope of obtaining at least partial later obliteration of the cavity. The wound was widely drained. On the third day after operation temperature rose to 105 and the patient's condition became critical, but temperature subsided after that time and the general condition began to improve. Cough and expectoration rapidly subsided.

Ten days after operation blood transfusion was given in order to improve the general condition. There was progressive increase in weight and strength and the patient was in satisfactory condition on his readmission to the hospital for a second operation one month after the first. At that time the purpose was to resect the anterior and superior part of the wall of the empyema cavity. Under gas, oxygen anæsthesia a long incision was made from the anterior axillary region downwards. The scapula was mobilized by severance of some of its musculature and was drawn backwards. The empyema cavity, now clean and empty, was entered and resection of ribs, intercostal tissues, and the entire parietal membrane was begun from below upwards. Long sections of the third to ninth ribs were removed. The anterior limits being the anterior limit of the empyema cavity and in each instance the rib was completely removed through its old posterior limit; in other words the entire thoracic cage was removed over the full limits of the empyema. The wound was closed in layers and a tube left in the old posterior drainage wound. The man did very well after operation. There

was a moderate amount of purulent discharge from the cavity, adequately cared for by irrigation.

After leaving the hospital progressive improvement in the general condition continued. There has never been any recurrence of cough or sputum. The patient has gained much in weight (65 pounds). He is symptom free. X-ray check-up of the chest showed at first a fairly wide empyema cavity. This has progressively reduced in size so that now a narrow chink remains. As a safety valve this is being kept open by a drainage tube. From the cavity there is an escape of small amounts of mucoid material sometimes admixed with pus. Doctor Neuhof thought it unwise to permit this cavity to close and proposes to continue with the drainage tube unless the discharge completely ceases.

TUBERCULOUS EMPYEMA WITH COMPLICATING PNEUMOTHORAX.

Dr. Harold Neuhof presented a man, now forty-eight years old, who first came under observation in June, 1927, with the history that he had been under treatment for pulmonary tuberculosis for eight years. After one year's illness pneumothorax therapy was begun for a widespread right sided pulmonary tuberculosis. This treatment was continued for many months. Excellent collapse was obtained, fibrosis of the right lung resulted, sputum became progressively more and more scanty, and has remained free from tubercle bacilli. Other than some discomfort on the right side of the chest the patient was symptom free until 1925. At that time there was a sudden attack of coughing accompanied by expectoration of a considerable quantity of pus. Purulent expectoration in varying quantities continued. About six months before the reporter first saw him the patient began to lose flesh and strength and the expectoration became progressively more profuse. There was fever from time to time. The patient finally had to remain in bed most of the time because of weakness and could not lie on his left side because expectoration of large quantities of pus and a choking sensation would follow directly upon the assumption of that posture. There was pronounced emaciation, moderate dyspnœ. He was constantly coughing with the expectoration of thick, purulent sputum. Examination of the chest disclosed advanced contraction of the right side with complete immobility. The percussion note was flat and respiratory sounds were almost inaudible. The X-ray picture was that of a dense, homogeneous shadow occupying the contracted right chest with the heart and the mediastinum partly drawn to that side.

The first operation, performed in June, 1927, under local anæsthesia, consisted in a free incision made over the posterior part of the right axilla. Two ribs were widely resected. The dense parietal membrane was aspirated and pus obtained. Plan was to attempt an obliteration of at least part of the empyema cavity. Accordingly the parietal membrane was widely stripped away to make a large extra-pleural dead space. Into this was turned large mobilized flaps of the latissimus dorsi and pectoralis major muscles. The skin was closed without drainage. The immediate post-operative course was satisfactory. Coughing and sputum rapidly subsided and were absent at the time of discharge from the hospital, one month after operation.

The patient was readmitted two months later with the history that he had been doing well for about a month. He then began to have recurrence of cough and purulent expectoration; the symptoms not being quite as severe as before operation. A small sinus had appeared in the wound and from this there was some discharge of pus. It was found to enter the empyema cavity

and lipiodol was introduced. The cavity was found to be reduced in size and communicated freely at its dome with the bronchial tree.

At operation the plan was to attempt more complete narrowing of the empyema cavity and it was thought in order to accomplish this the parietal membrane, as well as overlying ribs, would have to be removed. Under local anæsthesia a large "S" shaped incision was made through the right axilla. The pectoralis major and minor muscles were severed, freely exposing the second and third ribs. These were widely removed together with the intercostal tissues. The greatly thickened, infiltrated parietal membrane was excised over most of the empyema cavity. The cavity itself was entered at one point. For the most part, thin layer of pleura was all that was left over the parietal aspect of the empyema. The severed musculature was turned into the dead space and skin closed and a compression bandage applied. The immediate post-operative course was stormy—with fever, listlessness, and rapid, and feeble heart action. A definite interpretation of these phenomena was not made, but it was assumed that a quiescent tuberculosis had been lit up. Improvement began about the tenth day after operation and continued slowly. One month after operation the patient was convalescent with healed wound, showing depression of that part of the chest wall. There was very little cough and sputum.

After leaving the hospital the patient's condition progressively improved. It is now two years since the operation. There has been steady gain in strength and return of weight to that before the present illness began. There has been no cough or sputum since the time he left the hospital two years ago. X-ray check-ups show the pronounced narrowing of the chest wall in the operative field and a small remaining pneumothorax. This collection of air appears to be in process of gradual absorption and therefore adds, I believe, to the desired shrinking defect on the walls of the empyema.

Dr. James Alexander Miller said that from the standpoint of the early high mortality in Doctor Lambert's presentation, he felt he deserved a large share of the responsibility. In his anxiety to do everything possible for the patient he had urged Doctor Lambert to take risks he might otherwise not have done. In those early years the limitations of these operations were not known as they are today. This was not a fair test of the value of any new method of surgery. At the present time, internists are very conservative in selecting these patients for operation, letting those to whom surgery does not offer reasonably good chances go on the best they can without it.

This question of selection is very important from two aspects. First: The condition of the opposite lung, not only as regards the presence of tuberculosis, but its character and position and how it has behaved over a period of observation, whether quiescent or active or reasonably active. Second: The general condition of the patient. In tuberculosis we can afford to use a good deal of time to get the patient in shape for operation. If we can hold before them the promise of surgical relief we can often persuade them to take a strict rest cure and adapt themselves to proper environment so that instead of operating on them as an emergency when they are going downward, we will wait until they are on the upward grade.

Doctor Miller stressed another point, from the standpoint of the internist, and that was to beg the surgeons to do as little as possible in the way of

interference, which would involve the tuberculous tissue itself; also to divide the operation with several stages. It is better to take four or five chances in as many stages than to take too big a chance at once.

Last of all, he emphasized that these operations, as Doctor Lambert had brought out, are simply an incident in the treatment of a chronic disease; and that before the operation and during the stages of operation and after the operation, for a long time, for months and years they have tuberculosis for which they must be treated along definite conservative lines. If operation gives them freedom from local symptoms, from symptoms of active disease, then careful nutrition will increase their resistance and after a time enable them to take up an active life; become, in other words, arrested cases. Doctor Lambert and other surgeons use the word "cured"; in two years to four years they are considered cured. This, internists never do; after four or five years' freedom from symptoms they are still considered only apparently cured. There has been too much preaching about the curability of tuberculosis. It is a great mistake to forget that they may relapse under unfavorable conditions. No surgeon should take the responsibility of treating them without the coöperation of an internist skilled in their general management.

Doctor Howard Lilienthal agreed with Doctor Lambert that surgical operations upon the chest, intended to arrest or bring symptomatic relief in pulmonary tuberculosis, are justifiable when medical and hygienic treatment have failed, and when artificial pneumothorax has been unsuccessfully carried out or has been impossible to induce. In many cases the production of unilateral phrenic paralysis, temporary or permanent, should precede the direct attack upon the chest and it should sometimes take precedence over artificial pneumothorax.

Thoracic operations are of various types and must be selected according to the case in hand. Multiple procedures at intervals are nearly always required and the proper selection of type and extent is probably the most important function of the surgeon. Nearly anyone may quickly acquire technic, but good judgment is either innate or is one of the rewards of experience. Too often the physician assumes that there is *an* operation for pulmonary phthisis and that this is the now well-known paravertebral thoracoplasty of Sauerbruch. The surgeon should correct this impression, and the patient as well as the doctor, should be made to understand that the objective, clinical cure is only rarely attained by a single operation.

With regard to the usual form of thoracoplasty, the cases suitable for this treatment may be divided into two great classes: (*a*) Without the complication of purulent pleuritis; (*b*) Those with empyema in addition to the pulmonary disease. There is also a rare form of tuberculous empyema in which the lungs are apparently unaffected.

Regarding cases uncomplicated by empyema: First, there are those in which there is a favorable outlook as to improvement or clinical cure by operation. These are usually of the fibro-cavernous variety in which there

has been slow progress and with the cavities small in size. Second, the cases with great cavitation, usually apical, in which there has been unwarranted delay in spite of the steady advance of the lesion. Even here clinical cure, though less likely to be secured, is possible provided the condition of the contra-lateral lung is satisfactory and has remained stationary during two months, more or less, of observation.

Sometimes it is not the tuberculosis from which the patient is suffering, but some disturbance which may have been brought about by the healing process itself; *e.g.*, respiratory or cardiac distress from deviation of the mediastinum, due to contraction and adhesions. Patients have been seen with tremendous distorsion of the trachea and displacement of the heart toward the healed side, who were unable to make the slightest physical exertion without great dyspnœa. Complete relief followed thoracoplasty which permitted the heart and other mediastinal structures to assume more normal relations. In spite of having been helpless and bedridden, one of Doctor Lilienthal's patients, for years after the operation, was able to do her own housework and even tend her little garden.

Statistics.—Statistics are valuable in proportion to the number of their component units. A study of percentages in, say, one thousand cases is more apt to be convincing than one in which the results are culled from only a hundred. Add to the sources of error the element of the many individual operators with their varying personal equations and the unreliability of conclusions becomes very evident.

The possibility of error in estimating the cause of death and its relation to operation must be, in the last analysis, a matter of opinion, and all that one can ask is strict conscientiousness in making reports. To exemplify:—Œdema of the opposite lung within twenty-four hours was probably the result of the operation. A sudden and rapid extension of the disease may, or may not, have been produced by the operation. Hemoptysis is rarely the result of thoracoplasty and it may, of course, arise from either side of the chest. It is quite possible that massive atelectasis may have caused post-operative death.

It is obviously unfair to set a limit of post-operative time within which some untoward phenomenon—or even death—is to be ascribed to the operation. For example, if ninety days is the period set and the patient steadily deteriorates and dies on the ninety-first day, the case should not fairly be regarded as an example of unsuccessful surgery; while suicide or an unrelated accident on the eighty-ninth day, when the patient seemed to be doing well, ought not to be counted as an operative fatality.

Personal Experiences.—In his own work Doctor Lilienthal has not refused to operate in any case referred by a competent phthisiologist, no matter how unpromising the outlook provided, only, that the patient was not moribund, and provided also that the opposite lung presented sufficient functioning power to maintain life. Complications of cardiac, renal, intestinal or laryngeal disease not certainly of themselves fatal, did not deter him. The

mortality rate was high (24.4 per cent.) but was limited in all but two cases out of ten, to apparently doomed individuals. While most—not all—of the successful results were in those who seemed to have but a few months or even weeks to live. It was worth while.

There have been but three unexpected deaths; one from post-operative œdema of the opposite lung; one from undiagnosed diffuse tuberculosis of the opposite lung; one from causes which, in the absence of a post-mortem examination, could not be explained. In counting the deaths no time has been set, and this, of course, is not exactly fair, for some of the patients died many months, and others even years, after their thoracoplasty. He planned to publish later a full statistical report with all its opportunities for false conclusions.

Dr. Harold Neuhof said that at Montefiore Hospital the cases in which thoracoplasty might be indicated for pulmonary tuberculosis were carefully sifted and that only apparently favorable cases were referred to him for operation. Accordingly, these were cases in which there was an obvious effort towards contraction on the side of the disease, with fibrosis of the lung, narrowing of the intercostal spaces and drawing of the mediastinum and heart to the affected side. They were cases of long standing in which such suggested indications for operation as repeated hæmorrhage, profuse sputum, or long continued rise of temperature existed. As a result of this careful selection of material, the number of operated cases was relatively small and the mortality was naturaly lower than in the figures presented in the paper of the evening. It is, of course, an open question whether operation should be limited to this favorable group of cases. In them, however, a clearer impression of the prognosis can be had. Even in this group of cases the results have been variable. There have been cases in which a satisfactory outcome had been anticipated and in which it did not occur. The opposite also holds true, for there have been some instances in which operation did not appear to promise much of a result and in which satisfactory end results have been noted. There seems to be an intangible factor that cannot be influenced by the mechanical result of the collapse of the chest wall. It may be that it is dependent upon the difference in the behavior of the tuberculous process in different individuals.

BRIEF COMMUNICATIONS

GIANT URETERAL CALCULI*

THIS case is reported (1) as a freak of rare occurrence; (2) to illustrate the value of a two-step nephrectomy.

Reshower, in 1927, reported a case of stone in the lower third of the left ureter in a female tripara measuring twelve centimetres in length, without symptoms on the left side, accompanied by a small stone in the right ureter which produced severe paroxysmal pains on the right side, and states that "no ureteral stone nearly its size has been reported."

FIG. 1.—Röntgenogram showing large calculi in left ureter and large left kidney.

Young mentions one about the size of a small cigar.

Two-step Nephrectomies.—There have been two distinct surgical operations advocated for two-step nephrectomy. One, trans-abdominal ligation of renal vessels as suggested by Walker, Holt, Kellock, Quinby, Eisendrath and others to reduce the technical difficulties of nephrectomy or prevent metastases from renal tumors. Two, nephrostomy is done for drainage, as recommended by Chute Caulk, Bugbee, Cahill, Alcock and Crosbie.

In 1920 Chute reported twenty cases (with two deaths—one, tuberculosis; one perinephritic abscess) of secondary nephrectomy, nine of which the operation was intentional and eleven cases where the operation was forced upon the operator, either by difficulties arising at the time of operation, or by error of some sort, either in diagnosis or judgment.

* Read before the Wisconsin Urological Society, April 12, 1929.

Alcock, in 1925, reported seventeen cases of two-step nephrectomy, ten of which were intentional.

Two-step nephrectomy is not to be recommended as a routine procedure; it is a life-saving operation in the poor risk patient, who is toxic from a suppurating kidney. In such cases preliminary drainage allows the patient to rid himself of his sepsis before nephrectomy is attempted.

FIG. 2.—Röntgenogram showing two large calculi in left ureter.

CASE.—J. A. R., white, male, eighteen years of age. Referred by Dr. H. C. Schumm, January 24, 1927. History of tonsillectomy four years ago for recurrent attacks of follicular tonsillitis.

Present Illness.—One month ago complained of pain over left kidney which radiated down along left ureter and to left thigh. Treated by family physician for three weeks. When first seen had a temperature of 103°, pulse 100, and respirations 20. There was a large palpable mass in the left upper quadrant of the abdomen, painful on pressure, with muscle spasm in the left costovertebral angle. Urine—pus. He was admitted to Columbia Hospital January 31, 1927. Temperature 104.2°, pulse 100, respirations 18. Cystoscopical examination February 1, 1927. Gas æsthesia.

A No. 6 X-ray catheter was passed up the right ureter to the kidney pelvis with ease, and clear urine was obtained in drops. Pus was seen coming from the left ureteral orifice. A No. 6 X-ray catheter was passed up left ureter one centimetre, at which point obstruction was met. Filiforms could not be passed. Röntgenogram showed a large shadow in the left ureter just above the bladder with a very large left kidney. (Figs. 1 and 2.)

FIG. 3.—Two large calculi removed from left ureter.

Diagnosis.—Large ureteral calculi (2), left; with ureteral dilatation and pyonephrosis, left.

Laboratory Findings.—January 31, 1927. White blood cells 19,000, red blood cells 4,770,000, hæmoglobin 80 per cent., polymorphonuclears 75.5, small leucocytes 3.5, large leucocytes 2.5, transitionals 14.5, eosinophiles 3.5, basophiles 5, platelets normal. March 15, 1927. White blood cells 16,000.

Blood Chemistry.—February 1, 1927. Non-proteid nitrogen 37 milligrams per 100 cubic centimetres of blood. Urea 37.4 milligrams per 100 cubic centimetres of blood. Urea nitrogen 17.4 milligrams per 100 cubic centimetres of blood.

February 1, 1927.—Blood culture negative after forty-eight hours of incubation.

February 1, 1927.—*Urine:* right—negative, left—pus. *Culture:* Many small Gram-negative bacilli; few Gram-positive cocci.

Phenolsulphonephthalein Test.—February 1, 1927. *Right:* Appearance time three and one-half minutes, 15 per cent. elimination in fifteen minutes. *Left:* No trace in thirty minutes. February 24, 1927. *Right:* Appearance time three minutes, 15 per cent. eliminated in fifteen minutes. *Left:* No dye in thirty minutes (from ureter or nephrostomy wound). March 25, 1927. Appearance time two and one-half minutes, 18 per cent. eliminated in fifteen minutes. April 6, 1929. Appearance time three minutes, 25 per cent. eliminated in fifteen minutes.

FIG. 4.—Left kidney after nephrostomy, showing pyonephrosis and marked contraction.

February 14, 1927.—Ureteral calculi (1) measured 11 by 3.6 centimetres; (2) measured 7 by 1.5 centimetres. Weight together fifty grams, chemical examination gave calcium and magnesium phosphate reactions.

First Operation.—February 2, 1927. Nephrostomy. One thousand cubic centimetres of pus, temperature 103°, pulse 100, respirations 22.

Second Operation.—February 9, 1927. Ureterolithotomy, left, temperature 99°, pulse 92, respirations 20. (Two large calculi, Fig. 3.)

Third Operation.—February 25, 1927. Nephrectomy. (Fig. 4.) Temperature 99.2°, pulse 88, respirations 20.

Fourth Operation.—June 18, 1927. Ureterectomy, left. Temperature 98.4°, pulse 80, respirations 18.

At the time of the nephrostomy he was a very poor operative risk. Convalescence was fair and one week later two large stones were removed from the lower end of the left ureter, after which he continued to improve, with the urine containing a large amount of pus and moderate drainage from nephrostomy wound. February 24, 1927, or twenty-two days after the first operation, no function could be demonstrated from the left kidney and nephrectomy was recommended. After nephrectomy his general condition gradually improved, with the urine containing pus continuously and the temperature varied from 97 to 99.4°.

At cystoscopical examination June 16, 1927, pus was aspirated from the left ureter, hence ureterectomy was decided upon, after which convalescence was uneventful.

WILLIAM J. CARSON, M.D.
of Milwaukee, Wisconsin.

REFERENCES

[1] Reshower, I. C.: An Unusual Ureteral Stone. Amer. Jour. of Surgery, vol. ii, p. 386, 1927.
[2] Chute, A. L.: Secondary Nephrectomy. N. Y. Med. Jour., vol. cxi, p. 931, 1920.
[3] Caulk, J. R.: Preliminary Renal Drainage with Special Reference to the Two-stage Operation on the Kidney. ANNALS OF SURGERY, vol. lxv, p. 593, 1917.
[4] Bugbee, H. G.: Value of Preparation in Kidney Operations. Jour. of Urol., vol. vi, p. 51, 1921.
[5] Alcock, N. G.: Two-step Nephrectomy. Jour. of Urol., vol. xiv, p. 239, 1925.
[6] Crosbie, A. H.: Secondary Nephrectomy. Jour. of Urol., vol. xix, p. 81, 1928.
[7] Stevens, W. E.: Bilateral Ureteral Calculi. California and Western Medicine, vol. xxviii, p. 206, 1928.

TRANSPLANTATION OF A BILIARY FISTULOUS TRACT INTO THE DUODENUM

ACCORDING to his bibliography which is appended to this article, Hugh Williams was the first surgeon to anastomose a biliary fistulous tract to the duodenum.[1] This patient is reported well sixteen years following this operation, which indicates that biliary fistulous tracts, after draining to the surface for a more or less prolonged period, will remain permanently patent. Similar experiences have been reported by Lahey,[2 3] Lilienthal,[4] Masson,[5] F. B. St. John,[6] and Walters.[7] It is well known that biliary fistulous tracts, with an obstruction in the common duct, and also duodenal fistulous tracts, remain patent for an indefinite period which is often long enough to produce a serious loss of essential substances from the alimentary tract. The cause for the prolonged patency of these fistulæ is generally assumed to be due to the nature of the secretions transmitted. This suggests that when a common duct is destroyed or becomes useless, and can in no way be joined to the small intestine, a permanently patent biliary fistulous tract may be purposely formed, from the ducts above the obstruction, by prolonged drainage around a rubber tube; and after a few months' duration a transplantation of this newly formed channel may be made into the duodenum. In the case I am reporting I found the tract to be lined by many gland-like structures resembling intestinal mucous membrane. This is a desirable formation if the tract is to be transplanted as these glands will undoubtedly assist in keeping the lumen of the tract patent.

CASE REPORT.—This patient was a married woman, aged 38 years, with a previously negative history. In November, 1928, her gall-bladder and appendix were removed elsewhere, which operation was followed by a biliary fistula about seven days later. Two months after the first operation an attempt, elsewhere, was made to close the fistula by joining the amputated common duct to the duodenum. A few days later the patient became jaundiced and developed signs of peritonitis. The wound was then opened and a small rubber drainage tube was inserted down to the area of the last operation, which left a fistula draining duodenal contents and bile up to the time I first saw this patient in March, 1929. At this time she had lost fifty pounds and was confined to bed owing to extreme weakness.

For an area of about ten centimetres around the fistulous opening the epidermis

had been destroyed by the digestive juices, and the pelvic cavity contained about 2000 cubic centimetres of a thick bile-stained fluid which was contaminated by colors bacilli. The extreme weakness of the patient demanded fresh blood, several transfusions of which proved to be of the greatest benefit. Following the blood transfusions the pelvis was drained through a McBurney incision. The skin around the fistulous tract was completely healed over in two weeks by new skin through the use of saturated sodium bicarbonate solutions applied on gauze very frequently during the day and night. The use of dilute hydrochloric acid solutions containing proteins was tried at first, but they had only a moderate degree of healing or neutralizing effect over the pancreatic secretions. The patient was given 30 grains of sodium bicarbonate with 2 grains of magnesium oxide one hour after each feeding, which may have been of some assistance to the sodium bicarbonate solutions externally.

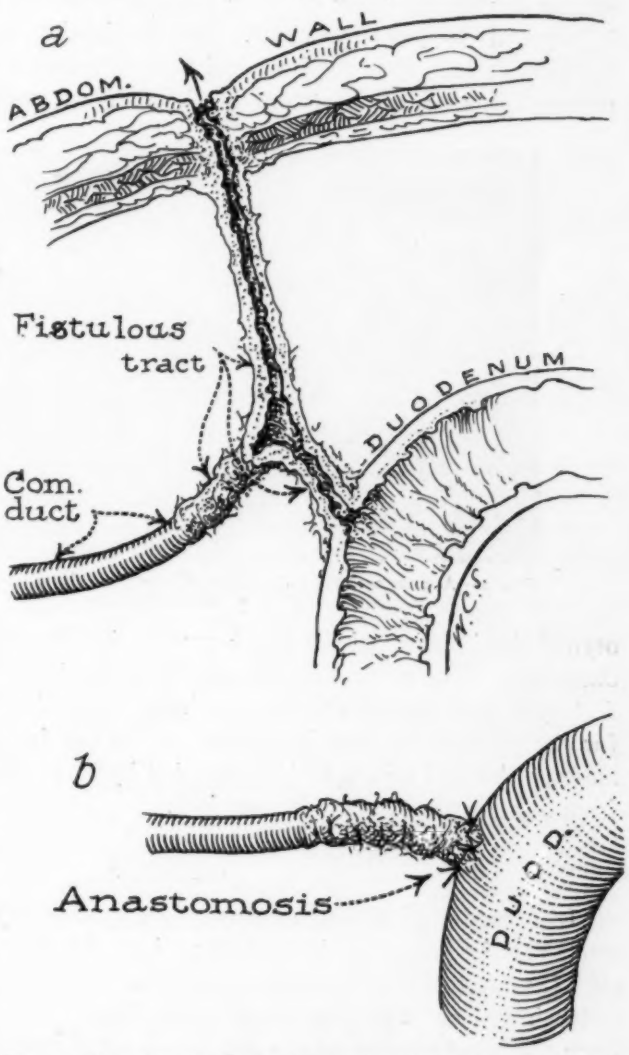

FIG. 1.—Side view of the fistulous tract draining the common bile duct and the duodenum.

About eight weeks after entering the hospital and with supportive treatment, this patient had almost regained her normal blood chemistry, and appeared in a condition for an exploration of the fistulous tract, with the idea of joining it to the duodenum if possible. About five centimetres below the peritoneal layer of the incision the tract divided into two channels (Fig. 1), one going into the duodenum and the other continuing upward into the common duct. The normal end of the common duct seemed to be separated from the duodenum for a distance of about 7 centimetres. The fistulous tract was cut free from the duodenum and abdominal wall and then joined to the duodenum as in Figure 1, with 00 chromicized catgut. The recovery was uneventful, the patient gaining weight and strength rapidly and four months after the operation, she was in perfect health, having gained fifty pounds.

Cross sections of the tract where the biliary and pancreatic segments joined,

showed the inner layer to consist of columnar epithelium in circumscribed areas. Many gland-like structures, the origin of which could not be determined, were found beneath the inner surface. These gland-like structures and areas of columnar epithelium resembled more the mucosa of the duodenum than the mucosa of the common duct. Their presence quite likely accounts for the tendency of these fistulous tracts to remain patent and drain biliary and duodenal secretions. Perhaps in time this inner layer would be similar in structure to the intestinal mucous membrane. Figure 2 is a photomicrograph of a cross section of the fistulous tract at about 1 centimetre

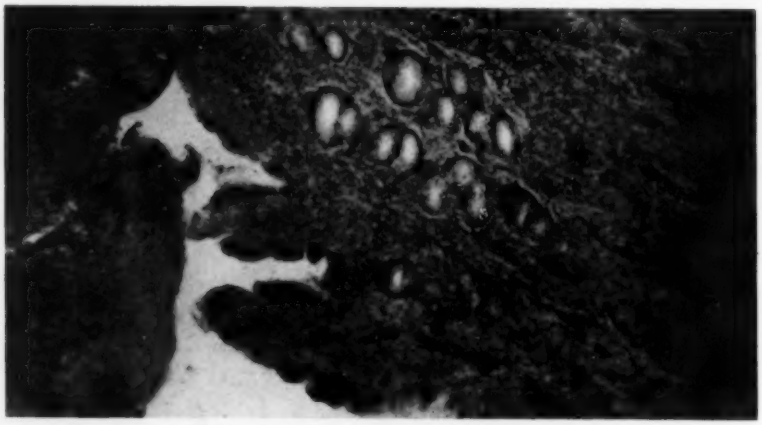

FIG. 2.—A cross section of the biliary-duodenal fistula taken just above the junction of the two tracts.

beyond the junction of the two segments draining the common duct and the duodenum. Through a misunderstanding, the desirable stained sections were destroyed and the undesirable specimens were kept intact. This accounts for the poor illustration in Figure 2. In the better sections I found the lumen to be well shown and surrounded by gland-like structures evaginating from a mucous membrane-like surface.

COMMENT

It is suggested that when necessity arises biliary and duodenal fistulous tracts may be purposely formed by prolonged rubber tube drainage, with the aid of supportive blood and alimentary tract chemistry, and later anastomosed to the intestine. The demonstration of glands in great numbers evaginating from the inner surface of the fistulous tract suggests a probable reason why these duodenal and biliary tracts fail to close before transplantation as well as remain patent following their anastomosis to the intestine. The presence of columnar epithelium and gland-like structures in these fistulous tracts and at a considerable distance from the mucosa of the common duct and duodenum demonstrates the proliferative powers of alimentary tract epithelium. It offers a similar example to the proliferative tendency of uterine mucosa. This report demonstrates the value of saturated sodium bicarbonate solutions

in the healing of skin denuded by pancreatic secretions. Dressings of such strong alkaline solutions seem to inhibit the activity of the pancreatic solutions as well or better than the acid solutions with or without proteins.

CLYDE A. ROEDER
Omaha, Nebraska.

BIBLIOGRAPHY

[1] Williams, Hugh, and Smithwick, Reginald H.: Treatment of Biliary Fistula by Direct Implantation of the Tract into the First Portion of the Duodenum, ANNALS OF SURGERY, vol. lxxxix, pp. 942–945, 1929.

[2] Lahey, F. H.: Implantation of Biliary Fistula into Duodenum, J. A. M. A., vol. lxxx, pp. 893–894, March 31, 1923.

[3] Lahey, F. H.: Treatment of Common Duct Biliary Fistulæ by Anastomosing Them into the Intestinal Canal, Surg. Clin. of N. A., vol. iv, pp. 1483–1487, 1924.

[4] Lilienthal, Howard: Chronic Biliary Fistula; Implantation of Sinus into Stomach, ANNALS OF SURGERY, vol. lxxvii, p. 765, 1923.

[5] Masson, J. C.: Personal Communication.

[6] St. John, F. B.: Late Results of Biliary Fistula with Implantation of Fistulous Tract into Stomach, ANNALS OF SURGERY, vol. lxxxiii, pp. 855–857, 1926.

[7] Walters, Waltman: Selected Papers of the Mayo Clinic, 1928.

CONGENITAL ABSENCE OF THE NECK OF THE FEMUR*

CONGENITAL absence of the neck of the femur is a comparatively rare anomaly and seldom enters into the differential diagnosis of congenital dislocation of the hip. However, this condition along with post-infective and post-paralytic dislocations and coxa vara, presents a similar clinical picture on cursory inspection, varying only in degree of deformity.

The history of a painless sinking limp, first noticeable when the child begins to walk, suggests the likelihood of a congenital dislocation of the hip. The usual confirmatory clinical features are the shortening of the limb, the upward displacement of the trochanter, the absence of the head from its normal position below the centre of the inguinal ligament and mild limitation of abduction with the other movements comparatively free. A positive Trendelenburg with elevation of the gluteal fold, gluteal fullness and lordosis are further points in evidence, and yet these clinical features are all demonstrable in cases of congenital absence of the neck of the femur. However, the comparative rarity of this anomaly prevents it from masking a congenital dislocation of the hip.

The cases on record of this condition are few and the purpose of this paper is to introduce one other case report. Robert Alph [1] in 1851 reported a case of bilateral congenital absence; Anger [2] in 1864 a unilateral case; Frieberg [3] in 1906 reported a case in a fifteen-year-old chrondrodystrophic dwarf. Ridlon [4] in 1909 reported a bilateral case, and Thomas [5] added one seen in 1911 at the age of two that failed to develop normal necks. Perrin [6] in 1913 referred to Duhmann's theoretical classification of congenital malformations of the femur: 1. Diminution in development of the upper epiphysis. 2. Ab-

*From the Department of Surgery, Washington University School of Medicine, Barnes Hospital and the Shriner's Hospital for Crippled Children.

sence of the upper epiphysis. 3. Absence of the upper epiphysis and diaphysis; and described a case of extensive arrest of development of the femur. Kidd [7] in 1911 described a case that would fall in the third of the above classification, in which the upper epiphysis and part of the shaft was lacking. Stone, Bloom and Huricques [8] in 1917 reported a case of congenital absence of the lower femoral epiphysis. Scaudto [9] in 1923, discovered by X-ray, in a child of five years, a unilateral absence of the entire upper epiphyseal nucleus and the neck of the femur. Nilsonne [10] described two cases that in infancy apparently had congenital defects of the upper femoral epiphysis which later showed coxa vara. Peabody [11] recently reported a case of bilateral defect of the femoral heads in a girl of twenty-three years. This apparently is the only adult case on record.

FIG. 1.—Röntgenogram taken at time of admission showing the agenesis of the neck of the femur.

Cohn,[12] in reviewing the literature, arrives at conclusions that were borne out by his own studies on epiphyseal centres and their subsequent ossification. There are three epiphyses for the upper end of the femur, one each, for the head, the greater and the lesser trochanters. The epiphysis for the head makes its appearance during the second half of the first year and is completely ossified during the sixteenth and eighteenth years. The epiphysis for the greater trochanter appears at the fifth year and ossifies during the fifteenth and sixteenth years. There is a bony prominence at the junction of the shaft and neck on the inner aspect of the femur which is probably the lesser trochanter. However, this prominence is definitely a portion of the shaft and not a separate epiphysis. At about the ninth year a separate scale-like epiphysis appears over the bony prominence which is completely ossified and united with the shaft during the sixteenth year. The neck of the femur is an upward growth from the shaft, a true process of extension *per se* which during the second year of life forms an obtuse angle expansion from the

upper portion of the shaft. It grows as a part of the shaft and is surrounded by three epiphyses, one for each trochanter and one for the head which eventually fits over it like a cap.

CASE REPORT: D. J. K., No. E 42. Service of LeRoy C. Abbott, the Shriners' Hospital for Crippled Children.

Admitted March 13, 1928. A female of five years with an irrelevant family history, who was the first child of youthful parents and a breech delivery. Some shortening of the right leg was noted at birth by the attending obstetrician, though this gradually became more pronounced. She walked at ten months with considerable limp, using her right foot hyperextended to accommodate because of her short extremity. It was possible for her to walk with her right foot at right angles, though this was very awkward because of the resultant pelvic tilt. Her general physical examination was negative except of her undersize and infected tonsils. She was 40.25 inches in height and weighed 32 pounds. She had the classical signs and symptoms of a congenital dislocated hip and was so diagnosed on several occasions before her admission. Her left leg was 19.5 inches long and her right 15 inches long. (A. S. S.-I., M.) Her right tibia measured 8 inches in length and the distance from her right A. S. S. to her tibial tubercle was 7 inches. X-rays of the pelvis were made and the report was as follows:

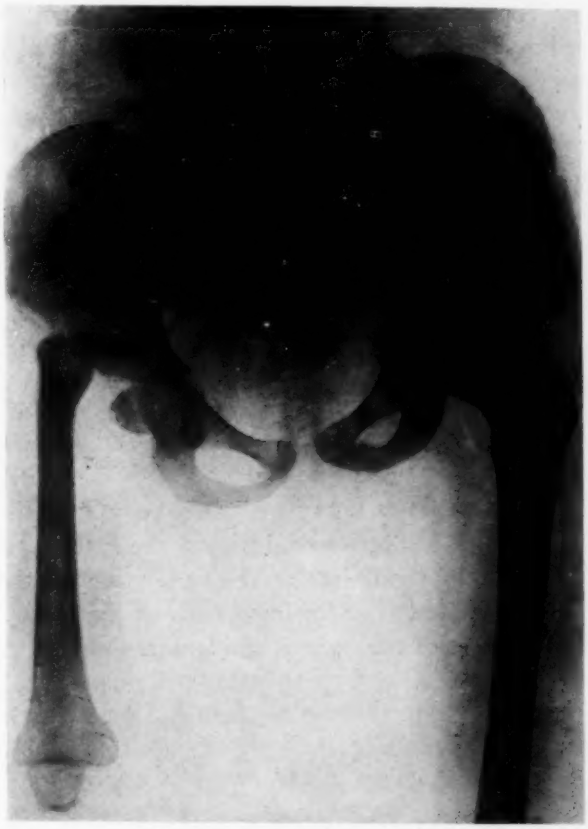

FIG. 2.—Röntgenogram illustrating the atrophy of the bones of the right lower extremity.

Antero-posterior view of pelvis and lower extremities including knees. The bones of the right lower extremity are relatively small and poorly developed as a result of less use than bones of opposite side. The right femur is approximately one-half the length of the left. This is due to the absence of a head, neck, trochanter, and approximately the upper third of the shaft of this bone. The nature of the bone indicates that the deficiency is of a congenital and not acquired origin, and though the upper extremity of this femur is bulbous, it does not have the characteristics of a femoral head and neck, even rudimentary. The upper end of this femur lies slightly above the level of acetabulum. *X-ray Diagnosis.* Agenesis of upper third of right femur.

On March 19, 1928, skeletal traction was instituted by means of a supracondylar Steinmann pin. The weight was increased by five pounds daily until thirty pounds was

employed. On April 7, 1928, X-ray revealed the upper end of the shaft to be opposite the acetabulum and the Steinmann pin was removed. On April 9, 1928, by means of a Smith-Peterson approach the hip-joint was opened. The head demonstrated in the X-ray was in the acetabulum and consisted almost entirely of cartilage. The shaft of the femur extended almost two inches above the level of the head. The neck of the femur was absent. Cartilage was removed from the upper end of the shaft and brought down to fit in the head in the shape of a ball and socket joint. The hip was fixed in an abduction spica. The sutures were removed June 12, 1929, and a similar spica reapplied. The patient was discharged July 24, 1928, to return in six weeks.

The avenues of speculation are certainly many in this instance. Can the sequence of events be traced in chronological order? The cartilagenous epiphyseal head of the femur is in its normal position as was shown by X-ray studies and confirmed by operation. There was no trace of a lesser trochanter as would be expected in a child of this age and the barest semblance of a greater trochanter. The question arises, when was the continuity of the femur broken, was there an early intrauterine separation of the epiphyseal head with subsequent upward displacement of the shaft? If this is true, perhaps the epiphyseal head plays a more important part in the formation of the neck of the femur than the röntgeneologists hold that it does. It is, however, safe to conclude that suppression of epiphyseal development in the upper end of the femur will result in absence of the neck.

SUMMARY

A case of congenital absence of the neck of the femur is reported and the literature briefly reviewed, bringing the cases reported up to twelve.

The epiphyseal sites of the upper end of the femur are discussed and questions raised as to the importance of the epiphyseal head in the subsequent development of the neck of the femur.

FRANKLIN E. WALTON, M.D.,
Saint Louis, Mo.

BIBLIOGRAPHY

[1] Alph: Des Vices Congenitaux de Conformation de Articulations. Paris, Germer Bailliere, 1851.
[2] Anger: Bull. Soc. Anat. de Paris, vol. xxxix, p. 365, 1864.
[3] Frieberg: Amer. Jour. Ortho. Surg., vol. lv., p. 184, 1906.
[4] Ridlon: J. A. M. A., vol. lii, p. 700, 1909.
[5] Ridlon and Thomas: Amer. Jour. Ortho. Surg., vol. x, p. 205, 1912.
[6] Perrin: Rev. D'orthop, 3me serie, vol. iv, p. 285, 1913.
[7] Kidd: Proc. Roy. Soc. Med., vol. iv., par 1, Chir. Sec., p. 158, 1911.
[8] Stone, Bloom, Huiricques; Arch. Pediat. vol. xxxiv, p. 1512, 1917.
[9] Scaduto; Pediatria, vol. xxvi, p. 194, 1923.
[10] Nilsonne: Acta. Radiol., vol. iii, p. 383, 1924.
[11] Peabody: Journ. Bone and Joint Surg., vol. iv, No. 2, p. 288, 1927.
[12] Cohn: Annals of Röntgeneology, vol. iv., p. 126, Hoeber, 1924.

IMPERFORATE ANUS WITH PERSISTENT CLOACAL DUCT

THE cases of Imperforate Anus are not so uncommon in medical literature, but the cases of a true cloaca persisting are extremely rare, and it is for this reason that we are reporting this case. During the early weeks of development of the embryo in utero, the entodermal cloaca pushes aside the mesoderm and approaches the surface, finally fusing. This area of fusion is known as the "Cloacal Membrane," which consists of two layers of entodermal and ectodermal. This membrane forms a septum between the cloaca and the urogenital fossa. The proliferation of the entoderm and mesoderm form the urorectal septum and this in turn divides the cloaca into the dorsal "rectal" and ventral "urogenital." This is followed closely by the peritoneum forming the recto vesical cul de sac. Fusion of the urorectal septum with the cloacal membrane forms the perineum, and divides the membrane into urogenital sinus and rectum. If the urorectal membrane fails to close completely with the cloacal membrane, the cloacal duct persists and the rectum communicates with the urinary bladder (Fig. 1.) The ventral portion develops into the bladder, prostate, membranous urethra and urogenital sinus. The dorsal portion forms the rectum.

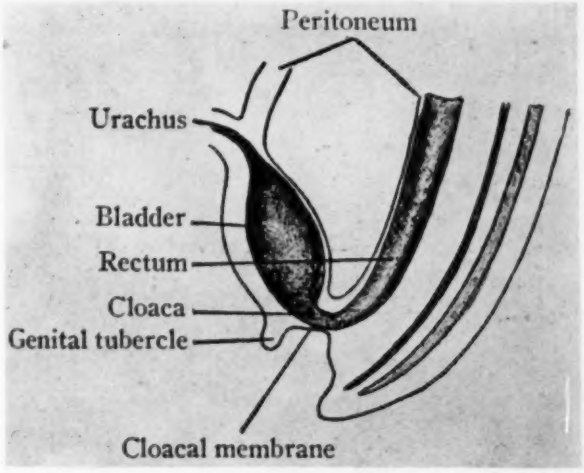

FIG. 1.—Shows the embryological formation of the cloaca and cloacal duct. (After Tieda. Yeomans in Cooke, Diseases of the Rectum and Anus. Courtesy F. A. Davis Co.)

Theories.—First. Invagination of the ectoblast at the site does not take place. Second. Rudimentary invagination, but anus remains imperforate and anal membrane persists in whole or part. Third. Post allantoic gut undeveloped, does not ascend and ends blindly. Fourth. Post allantoic gut descends but grows backward and remains out of alignment with the proctodeum and the intervening tissue not absorbed. Fifth. Growth of cloacal partition is arrested and communication is made between rectum and parts in front of it.

Imperforate anus is not a common occurrence, many large hospitals not having a record of a single case. This case we are presenting is very rare, as there is a true cloacal duct and no external communication with the surface. During the process of development, arrestment may occur at any point below the promontory of the sacrum. This being the case there may be a communication with the 1, vagina; 2, urinary bladder; 3, urethral outlet; 4, spinal outlet; 5, uterus; 6, ureters; 7, vulval outlet; 8, perineum, scrotum, anterior urethra; 9, prepuce. The developmental defect communicating between the

rectum and urinary bladder is very rare. Yeomans [14] collected forty-five cases of Imperforate Anus, and did not find a single case presenting this anomaly. Fetchet [5] collected thirty-one cases occurring between 1873 and 1926 and reported one such case as the one we are reporting. Others who have reported cases are Bordenhauer,[3] Anders,[14], Curling,[14] Hayes,[6] Cripps,[4] Tuttle,[11] and Helwig.[7]

Occurrence.—Imperforate anus occurs in a different ratio according to different writers, some estimate once in twenty-five thousand births, Starr estimates its occurrence once in ten thousand births.

Sex Incidence.—In an analysis of thirty-three cases by Fetchet [5] there were thirteen females, or thirty-nine per cent. Twenty males, or sixty-one per cent., showing that it is more common in males than females.

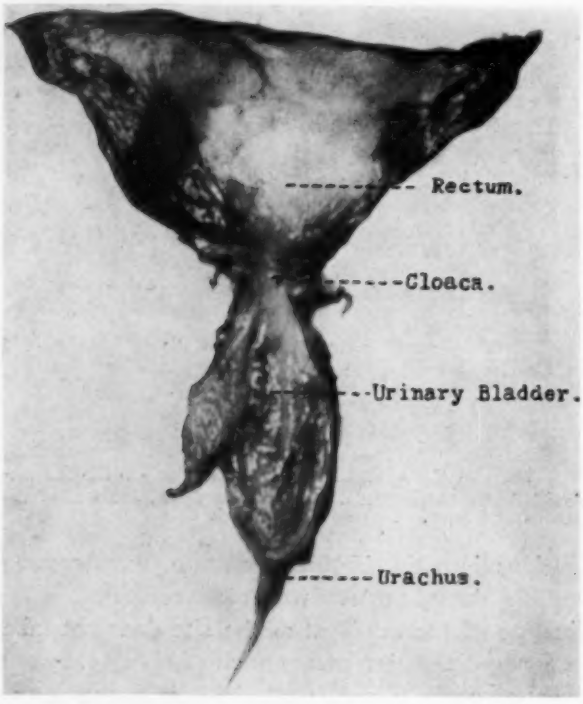

FIG. 2.—Showing gross specimen with persistent cloacal duct, which communicates the distal colon with urinary bladder.

The prognosis depends a great deal upon the type of anomaly and its communication, also any other type of anomalies present. If the imperforate anus does not have communication with some other viscus or with the skin surface, symptoms of obstruction are present at once. Morgagni reported a case of a female with a communication between rectum and vulval outlet who lived to be a hundred years, bore and reared a family of several children and was not aware of her anomaly. The causes of death are distention of the bowel with gas and intestinal paralysis, vomiting with dehydration, acidosis and peritonitis. The surgeon may do a colostomy or ileostomy, but if intestinal paralysis is present the relief is nil.

Treatment.—If there is a fistulous communication with the skin surface in the perineum, this should be dissected out and establish its communication with the surface. If there is no external fistula, and about forty per cent. have an external fistulous opening, one should explore the perineum first to see if he can palpate any pulsation of the bowel, and if he can, then the bowel can be delivered and temporary drainage instituted. If no bowel is encountered the surgeon should not waste any time exploring, but should go above in

the left mid-line and do a colostomy or ileostomy. One must always remember that this is an emergency procedure and no time should be wasted, as the child is only a few hours or few days old, and a bad risk to start with, and it is of the greatest importance to save time.

CASE REPORT.—Father thirty-four, living and well. Mother thirty, in good health. One child, three, in good health. No congenital anomalies in the family. (Dr. A. A. Fricke.)

This infant was of normal pregnancy, normal term, and normal delivery. There was no complication at any time during the pregnancy. Birth of the child was on August 5, 1929. Weight, 7 pounds and 8 ounces, male. After delivery on physical inspection there was visible a small fold of dark pigmented skin in the mid-line of the perineum, also an increase in the size of the scrotum. There was no external rectal or fistulous opening. No other external anomalies were present. The presence of an Imperforate Anus was evident. The infant was taken to the operating room several hours later. After infiltration of the skin in the mid-line of the perineum with one-fourth per cent. novocain, a mid-line skin incision with blunt dissection was done. After blunt dissection no bowel could be palpated, and no pulsation of the bowel was seen when the child cried, as often is the case in this type of anomaly. A rather firm ridge could be palpated which was reported to be a persistent fibrous urogenital fold. Under one-fourth per cent. novocain a left rectus incision was made and a colostomy was done. This colostomy drained very little and the child retained very little nourishment, and died after four days.

Autopsy made by V. L. Andrews, pathologist Hollywood Hospital, showed the distal sigmoid colon to be dilated and through a hard fibrous duct to communicate with the urinary bladder. (Fig. 2.) There is no fecal material in the urinary bladder. The seminal vesicles, and vas deferens are apparently normal. The ureters enter the urinary bladder in the relative normal position. There are no ulcerations or hæmorrhages in the bowel.

The reason for presenting this case is that it is very rare, and presents a true cloacal duct with communications between the distal sigmoid and urinary bladder. Also there was no fistulous opening communicating with the surface, a condition that exists in about forty per cent. of the cases. The surgical treatment in this type of case has very little to offer. The cases occurring with imperforate anus and absence of the rectum have a mortality of approximately 100 per cent.

EDWARD J. KILFOY, M.D.
of Los Angeles, California

BIBLIOGRAPHY

[1] Ball, C. B.: The rectum. Its Diseases and Developmental Defects. London, 1908.
[2] Bell, L. P.: Surgical Treatment of Imperforate Anus with Report of a Case. Am. J. Obst. and Gynec., vol. xiv, pp. 603–608, 1927.
[3] Bordenhauer, Wm.: Congenital Malformations of the Rectum and Anus. S. S. and Wm. Wood. N. Y., 1860.
[4] Cripps, Harrison: Diseases of the Rectum and Anus. London, 1907.
[5] Fetchet, S. M.: Bost. Med. and Surg. Jr., vol. cxcv, p. 195, July 1, 1926.
[6] Hayes, H. T.: Congenital Malformations of Anus and Rectum, Report of three cases. M. Rec. A., vol. xxi, pp. 319–321, 1927.
[7] Helwig, F. C.: Imperforate Anus with Exit through the Prostatic Urethra. Am. Jr. Dis. of Children, vol. xxxviii, No. 3, pp. 559-561, 1929.

[9] Matas, Rudolph: Cyclopedia of Diseases of Children, vol. v, Philadelphia, 1899.
[9] Mukerji, S. N.: Case of Imperforate Anus. Indian M. Gaz., vol. lxvi, pp. 521–522, 1927.
[10] Thomas, A. K.: Unusual Developmental Abnormalities of Imperforate Anus. Brit. M. J., vol. ii, pp. 985–986, 1927.
[11] Tuttle, Jas. P.: Diseases of the Anus and Rectum and Pelvic Colon. D. Appleton and Co., New York, 1902.
[12] Thomas, A. K.: Unusual Developmental Abnormalities of Imperforate Anus. Brit. M. J., vol. ii, pp. 985–986, 1927.
[13] Yeomans, F. C.: In Cooks Diseases of the Rectum and Anus. F. A. Davis and Co., Philadelphia, 1914.
[14] Yeomans, F. C.: Proctology. D. Appleton and Co., New York, 1929.

BOOK REVIEWS

ORTHOPEDIC SURGERY. By Sir ROBERT JONES and ROBERT W. LOVETT, M.D. Second Edition revised, with the collaboration of Nathaniel Alison and Frank R. Ober, M.D., and Harry Platt, M.D. William W. Wood & Co., 1929.

The second edition of this valuable text-book appears after the death of its distinguished American co-author. The collaborators from both sides of the water have seen to it that the new edition is thoroughly modern in its presentation of the developments in orthopedic surgery since the first edition was issued.

In a very brief discussion of the work as a whole, several thoughts come to mind. In this volume are amalgamated the theory and practice of two great schools of this somewhat ill-defined but ever-growing specialty. These two schools agree very largely in viewpoint and enthusiasm. Yet it is relatively easy to discover, in perusing its pages, wherein they vary in practical applications. And therein perhaps lies the peculiar value of the work.

The sections dealing with what may be termed "pure" orthopedics are adequately represented and well elaborated, with perhaps one single exception, and that is in the discussion of coxa vara. Since in the presentation of coxa vara comparatively little emphasis is placed upon the commoner clinical types, the treatment outlined is correspondingly vague and not entirely satisfactory.

The sections dealing with disabilities of the knee-joint and with cerebral palsies of childhood deserve careful reading as the expression of pioneer work done by the authors. The sections dealing with fractures merge with the field of the general surgeon, but emphasis is placed upon those fractures in which the orthopedic surgeon is commonly consulted, that is fractures involving joints.

The work is to be highly recommended to all students and practitioners interested in the pathology and treatment of injuries and disorders of the locomotor apparatus.

ARTHUR KRIDE.

SURGICAL PATHOLOGY. By WILLIAM BOYD, M.D. 2nd edition, 8vo. cloth; 898 pages. Phila., W. B. Saunders Co., 1929.

The opening sentence in Boyd's book is "The Surgery of today is based on pathology." This author goes on to divide the history of surgery into two periods—before John Hunter and after, in effect that before Hunter it was content to be an art founded on empiricism and after him it aspired to be a science founded on pathology.

The second chapter is devoted to "The Surgeon and the Laboratory." In this are considered the surgical infections, vaccines, sera, methods of collection of material, cytologic examination of the fluids obtained from the end results of malignant involvement, leucocytosis and blood transfusion.

The comment on this chapter applies equally to the one following (Inflammation and Repair), namely: the thoroughness with which the subjects are dealt merits commendation.

From special chapters devoted to tubercular, mycotic and luetic surgical affections as well as thrombosis and embolism, the author digresses a little to consider surgical shock and the etiology of tumors and heredity in cancer. While strictly speaking these are not subjects of surgical pathology, the material is so well handled, that it becomes a pleasant digression to the reader.

Only moderate space is devoted to the benign tumors, but the more malignant (especially carcinoma) are considered at length and are taken up in correct detail with the individual organs.

The surgeon must not only see but he must understand what has gone before and what is most apt to follow and the student of Boyd's Surgical Pathology will forgive the author his interspersions of physiology, physical diagnosis and prognosis. For the lack of these is the great fault of some other works.

Especially luminous are the chapters on the stomach, peritonitis and surgical affections of the genito-urinary tract. The vividness and clarity with which these subjects are described is worthy of any comprehensive work on physical diagnosis and certainly leaves little undescribed as to what the surgeon may encounter, and encountering, judge the outcome.

One might take exception to the inclusion of such a subject as status lymphaticus, but as the author observes, many cases of death under anæsthesia are due to this cause.

The student will find the chapters on bone and joint pathology especially useful in differential diagnosis and a definite aid in the choice of treatment to be instituted.

It is a satisfaction to note that Boyd believes in syphilis of bone as a distinct pathological entity, and that rickets, osteo-malacia and osteitis deformans are states with which the surgeon must be familiar. Frequently their existence may prove a potent factor in medico-legal practice and worse still in unfavorable outcome.

The reviewer feels that the subject of tumors of the bone is not as amply treated as one would expect after perusing the subject of osteomyelitis, but the primary tumors are well described and one must agree with him that the bewildering variety of names encountered in the literature regarding this subject are of doubtful value, and quite confusing. The four main types of primary tumors are stated to be osteogenic sarcoma, Ewing's tumor, myeloma and giant-cell tumor. The recognition of these types practically covers the field of surgical pathology of bones.

In conclusion a surgical pathology like a surgical anatomy, is difficult to comprehend without clinical embellishment and for his ability to so embellish his work, this author is to be highly commended.

BARNET JOSEPH.

MINOR SURGERY, by FREDERICK CHRISTOPHER, M.D. Large octavo; cloth; pp. 694. Philadelphia, W. B. Saunders Co., 1929.

The remarks anent the subject of Minor Surgery, in reviewing, in the September ANNALS, the book of Foote and Livingston, are equally applicable, *mutatis mutandis*, to this book of Christopher, the chief change being that the one book comes from the city of New York and the other from the city of Chicago.

Here is a book of 694 octavo pages with 465 illustrations, many of which, though diagrammatic, illustrate well important points. There is one peculiarity about the book which cannot fail to arrest attention, that is the inclusion of certain fractures which the author says "may properly be included in the domain of Minor Surgery." "The care of others, however," he says, "is distinctly a major surgical procedure and will require all the skill and ingenuity possible." Naturally the question of what injuries should be included and what excluded may be subjects of difference of opinion. One point, however, in this connection the reviewer observes with regret, namely, that the author refers to plaster bandages used in the treatment of certain fractures, as plaster casts! Will the surgical profession ever free itself from that egregiously, erroneous use of language?

Under the heading of Minor Surgical Technique, there are only three pages devoted to local anæsthesia—all that the author has to say upon the subject. When one considers, however, the very great importance and increasing extent of the application of local anæsthesia in surgical work, one cannot help but feel that more detailed attention should be given to this subject in a work on Minor Surgery. The subject of Bandaging also, which certainly covers a very large field in Minor Surgery, receives very scant attention, only a half dozen pages being devoted to this subject.

The book as a whole, however, reflects well the character of the surgical practice of today. The dictum of the author in his preface that "there cannot be too much instruction in minor surgery" is well founded. The tendency of the present day is for every neophyte to rush into major surgery. The present book should help to stem that tendency.

THE PREPARATION OF CATGUT FOR SURGICAL USE. By W. BULLOCH, L. H. LAMPITT, and J. H. BUSHILL. Octavo, paper; pp. 186. London, His Majesty's Stationery Office, 1929. New York: British Library of Information, 5 East 45th Street.

A report from the Medical Research Council of the Privy Council; a series of studies made on behalf of the London Hospital Catgut Department.

Next to freedom from bacterial contamination in operative work, the use of an absorbable ligature is the most essential element of modern surgery. The use of non-absorbable materials for ligature purposes, such as silk or silver clips, is so restricted in its application as to be practically ignored in general use, although their mention may not be omitted in connection with certain classes of surgical work or the work of certain surgeons. Catgut, as

the absorbable ligature *par excellence,* is therefore of very great importance in modern surgery and every fact bearing upon its sterility and tensile strength is of deep interest. Lister labored for over forty years to improve the modes of its preparation. The present work by Professor Bulloch and his collaborators will stand in historical succession to the classical studies of Lister. It is of interest to note that in addition to the contributions to the bacteriology and physical chemistry of surgical catgut which the book makes, it contains a most complete account of the history and literature of the whole subject.

The importance of such a series of studies is well illustrated by the fact, as reported by the committee, that of eight batches of catgut ligatures, made by different English and American makers, purchased in July, 1927, some infection was found in every batch, and in five of the batches, not more than one ligature out of the ten was found to be free from infection. Of one particular batch, thirty-six ligatures were tested and every one of them proved to be infected, although the maker had claimed that all were sterile. For good reason, therefore, the licensing authority of Great Britain, under the Therapeutic Substance Act, has added surgical catgut to the list of substances to be controlled by it, so that in Great Britain at least the catgut supplied for surgical operations will have a sufficient guarantee as to the purity and quality claimed for it. Would that some similar authority could be given the supervision of the catgut supplied for surgeons' use in the United States of America, such an official guarantee should be welcomed by the great purveyors of catgut ligatures upon whom surgeons have come to depend so largely for trustworthy ligature material.

A distinction must be made, however, between practical clinical sterility and laboratory sterility. In the laboratory, the tests to which the catgut must be subjected are elaborate and minute. One is interested to read that the reporter has made not less than thirty thousand bacteriological tests of catgut ligatures. Surely such an experience must qualify him to speak as an authority. He says that the proof of sterility should be made only after complete removal of any disinfectant if such has been used for the purpose of sterilization; second, the cultures should be made in such a way that both anærobes and ærobes can grow in the medium employed; third, the nature of the bacteria cultivated should be examined with object of finding whether they are part of the intestine flora or merely an ærial contamination; fourth, the pathogenic action of the whole mixed culture obtained or particular bacteria isolated pure from the mixed culture should be investigated; fifth, inoculation of filtrates from catgut cultures may be necessary to reveal the presence of some bacterial toxin such as tetanus; sixth, the quantity of catgut employed for the test is not a matter of indifference. Since in practical use a length of from twelve to fifteen inches is used by a surgeon, such a length should therefore be the quantity used for the tests. Such is the character of the test for sterility to which the authors have subjected the catgut examined by them and which is the subject of this report. It is not to be

forgotten, however, that in the clinic catgut is subjected to quite a different kind of test. The catgut is not subjected to the removal of the disinfectant which has been removed for its sterilization. On the contrary, such disinfectant is always present and, as all surgeons know, whether the catgut is absolutely sterile or not from the laboratory standpoint, from the clinical standpoint it may be innocuous, due to the inhibiting action of the disinfectant present in its meshes. This is recognized by the experimenters in their statement that whatever penetration of an antiseptic has taken place in the substance of the catgut, its inhibiting action may give deceptive results, for the catgut may be washed for a very long time in many changes of sterile distilled water and still enough of the antiseptic may adhere to the catgut to inhibit the growth of any contained bacteria even if transferred to a highly nutritive medium. No doubt, therefore, a good deal of the catgut used is not dangerous even if it contains bacteria. But where harmless bacteria are found, there may be harmful bacteria also, and if all bacteria can be excluded, they should be. Although a great deal of so-called sterile catgut is not sterile, one must assume that the bacteria present are relatively innocuous. The comparative rarity of infections which can be traced to infected catgut, notwithstanding the enormous extent of its use and its possible imperfect sterilization, is apparently due to such inhibiting action of the disinfectants used in its preparation and retained in its substance. This penetration of chemical substances into catgut was also subjected to study. The general statement is made that owing to the physical or chemical properties of catgut almost all substances experience difficulty in effecting an entry into the fibres. This is the reason why the disinfection of catgut is such a troublesome affair. The experiments of various observers along this line are referred to. Especially significant is the work of Claudius (1906) in drawing attention to the rapid penetration of aqueous iodine solutions into catgut ligatures. Claudius found that aqueous solutions of iodine penetrated to the centre of ligatures very quickly; not so ligatures immersed in alcoholic or acetone solutions of iodine.

The methods of disinfecting catgut are most fully considered and occupy more than half of the space of the whole report. Successively carbolic acid, corrosive sublimate, biniodide of mercury, chromic acid, silver compounds, oil of juniper, oil of turpentine, formaline, hydrogen peroxide, aniline dyes, anhydrous fluids at high temperatures and hot air are passed under examination. These pages form a most interesting section of the report. To one who, like the reviewer, has been familiar with each of the methods considered from the very beginning of Lister's experiments with carbolic acid through all the gamut of change to the present time, it is full of interesting reminiscences. It may suffice, however, here to give the conclusions of the reporters as contained in their summary, namely that the preparation of catgut for surgical use on a large scale resolves itself into chemical sterilization by iodine or peroxide of hydrogen or the physical sterilization by heat. In the experiments given it is stated to be of importance to remove the iodine from the ligature after it has completed its sterilizing action because of its weakening effect on

its tensile strength and the practical recommendation is made that seventy per-cent. alcohol should be used for the storage of ligatures since it also serves to remove the excess iodine. It is recommended also that to this iodine there be added a small amount of glycerol, five to ten per cent., the glycerol rendering the texture of the catgut soft and flexible and more suitable for surgical use. Appended to the report is an extensive list of references. The whole report is one of great interest and importance dealing as it does with practical questions that interest every surgeon.

LEWIS S. PILCHER.

EDITORIAL ADDRESS

The office of the Editor of the Annals of Surgery is located at 115 Cambridge Place, Brooklyn, New York. All contributions for publication, Books for Review, and Exchanges should be sent to this address.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

ANNALS of SURGERY
227-231 South Sixth Street
Philadelphia, Penna.